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State of Delaware

Final Submittal

DELAWARE STATE IMPLEMENTATION PLAN FOR ATTAINMENT OF THE 8-HOUR OZONE NATIONAL AMBIENT AIR QUALITY STANDARD

Reasonable Further Progress and Attainment Demonstration

Submitted To
U.S. Environmental Protection agency

By

Delaware Department of Natural Resources and
Environmental Control

June 2007

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Executive Summary

In April 2004, the Environmental Protection Agency (EPA) designated 126 areas of the country as "non-attainment" under the 8-hour ozone National Ambient Air Quality Standard (NAAQS). Among those non-attainment areas is the Philadelphia-Wilmington-Atlantic City (PA-NJ-MD-DE) Moderate Non-Attainment Area (NAA). This NAA includes three counties in Delaware, five counties in eastern Pennsylvania, one county in Maryland and eight counties in southern New Jersey. According to the federal Clean Air Act (CAA), this entire NAA must attain the 8-hour ozone NAAQS by 2010.

Ground level ozone, one of the principal components of "smog," is a serious air pollutant that harms human health and the environment. High levels of ozone can damage the respiratory system and cause breathing problems, throat irritation, coughing, chest pains, and greater susceptibility to respiratory infection. High levels of ozone also cause serious damage to forests and agricultural crops, resulting in economic losses to logging and farming operations.

This document contains Delaware's State Implementation Plan (SIP) revision for meeting the requirements associated with the 8-hour ozone NAAQS. Specifically, this SIP revision:

- Fulfills the federal Clean Air Act's requirements for Reasonable Further Progress (RFP) and Attainment Demonstration (AD) under the 8-hour ozone NAAQS.

- Builds on, and strengthens control measures that were adopted and implemented under the 1-hour ozone NAAQS, which also serve as maintenance measures for maintaining the attainment status of the 1-hour ozone NAAQS in Delaware.

- Demonstrates that with all existing and proposed controls, Delaware will meet the RFP requirements on VOC and NOx emission reductions in 2008, and AD requirements on VOC and NOx emission reductions in 2009. In particular, all Delaware's ozone monitors will show attainment in 2009.

- Demonstrates that the entire Philadelphia-Wilmington-Atlantic City, PA-NJ-DE-MD moderate non-attainment area will attain the 8-hour ozone NAAQS in 2009.

- Confirms Delaware's 2008 and 2009 mobile source budgets for transportation conformity determination.

- Treats emission reduction credits (ERCs) banked under Regulation No. 34, Emissions Banking and Trading Program, as "emitted." As such, the future use of these credits is consistent with, and will not interfere with any calculation or provision of this SIP.

Acronym List

ACT	-	Alternative Control Techniques
ALAPCO	-	Association of Local Air Pollution Control Officials
AQMS	-	Air Quality Management Section of DNREC
BEA	-	Bureau of Economic Analysis
BOTW	-	Beyond-on-the-way
CAAA	-	Clean Air Act Amendments of 1990
CAIR	-	Clean Air Interstate Rule
CEM	-	Continuous Emission Monitor
CMSA	-	Consolidated Metropolitan Statistical Area
CO	-	Carbon Monoxide
CTG	-	Control Technology Guidance
DelDOT	-	Delaware Department of Transportation
DNREC	-	Delaware Department of Natural Resources and Environmental Control
DOE	-	US Department of Energy
EGAS	-	Economic Growth Analysis System
EGU	-	Electric Generating Unit
EIA	-	Energy Information Administration
EID	-	Emission Inventory Development Program of AQMS
EPA	-	United States Environmental Protection Agency
ERC	-	Emission Reduction Credit
FIP	-	Federal Implementation Plan
FMVCP	-	Federal Motor Vehicle Control Program
HPMS	-	Highway Performance Monitoring System
I/M	-	Inspection and Maintenance Program
IPM	-	Integrated Planning Model
LEV	-	Low Emission Vehicle
MANE_VU	-	Mid-Atlantic and Northeast Visibility Union
MARAMA	-	Mid-Atlantic Regional Air Management Association
MPO	-	Metropolitan Planning Organization
mmBTU	-	Million British Thermal Unit
NAA	-	Non-Attainment Area
NAAQS	-	National Ambient Air Quality Standard
NACCA	-	National Association of Clean Air Agencies
NEI	-	National Emission Inventory
NESCAUM	-	North-East Stats for Coordinated Air Use Management\
NIF	-	National emission inventory Input Format
NLEV	-	National Low Emission Vehicle
NOx	-	Oxides of Nitrogen
OTAG	-	Ozone Transport Assessment Group
OTB	-	On-the-book
OTC	-	Ozone Transport Commission
OTR	-	Ozone Transport Region
OTW	-	On-the-way
PM	-	Particulate Matter
POTW	-	Publicly Owned Treatment Works
QA-QC	-	Quality Assurance-Quality Control
RACM	-	Reasonably Available Control Measure

RACT	-	Reasonably Available Control Technology
RFP	-	Reasonable Further Progress
RPO	-	Regional Planning Organization
RRF	-	Relative Response Factor
RVP	-	Reid Vapor Pressure
SCC	-	Source Classification Code
SIC	-	Standard Industrial Classification
SIP	-	State Implementation Plan
STAPPA	-	State and Territorial Air Pollution Program Administrators
TIP	-	Transportation Improvement Program
TSD	-	Technical Supporting Document
VMT	-	Vehicle Miles Traveled
VOC	-	Volatile Organic Compound

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1. Introduction and Background

This document contains Delaware's State Implementation Plan (SIP) revision for meeting the requirements of Reasonable Further Progress (RFP) toward attainment of the 8-hour ozone National Ambient Air Quality Standard (NAAQS), which was set at 0.08 parts per million (ppm) by US Environmental Protection Agency (EPA) in 1997. The document also demonstrates that Delaware, and the entire Philadelphia-Wilmington-Atlantic City (i.e., PA-NJ-MD-DE) moderate non-attainment area will attain compliance with the 8-hour ozone standard by 2010. The document is hereafter referred to as "Delaware's 8-hour ozone SIP revision," or simply as "the ozone SIP."

1.1 Background and Requirements

Ground level ozone, one of the principal components of "smog," is a serious air pollutant that harms human health and the environment. High levels of ozone can damage the respiratory system and cause breathing problems, throat irritation, coughing, chest pains, and greater susceptibility to respiratory infection. High levels of ozone also cause serious damage to forests and agricultural crops, resulting in economic losses to logging and farming operations. In April 2004, EPA designated 126 areas of the country as "non-attainment" under the 8-hour ozone NAAQS (*69 FR 23858*). Among those non-attainment areas is the Philadelphia-Wilmington-Atlantic City (PA-NJ-MD-DE) Moderate Non-Attainment Area (NAA) that includes three counties in Delaware, five counties in eastern Pennsylvania, one county in Maryland, and eight counties in southern New Jersey, as shown in Figure 1-1. Since this moderate NAA is centered by Philadelphia, it is often referred to as "Philadelphia NAA." According to the CAAA, the entire Philadelphia NAA must attain the 8-hour ozone NAAQS by 2010, the attainment year.

Ozone is generally not directly emitted to the atmosphere; rather it is formed in the atmosphere by photochemical reactions between volatile organic compounds (VOC), oxides of nitrogen (NO_X), and carbon monoxide (CO) in the presence of sunlight. Consequently, in order to reduce ozone concentrations in the ambient air, the Clean Air Act Amendments of 1990 (CAAA) requires all non-attainment areas to apply controls on VOC and NO_X emission sources to achieve emission reductions.[1]

Among effective control measures, the Reasonably Available Control Technology (RACT) controls are a major group for reducing VOC and NO_X emissions from stationary sources. Section 182 of the CAAA sets forth two separate RACT requirements for ozone non-attainment areas. The first requirement, contained in section 182(a)(2)(A) of the CAAA, and referred to as RACT fix-up, requires the correction of RACT rules for which EPA identified deficiencies before the Act was amended in 1990. The second requirement, set forth in section 182(b)(2) of the CAAA, applies to moderate or worse ozone non-attainment areas as well as to marginal and attainment areas in ozone transport regions (OTRs) established pursuant to section 184 of the CAAA, and requires these non-attainment areas to implement RACT controls on all major stationary VOC and NO_X emission sources and on all sources and source categories covered by Control Technique Guidelines (CTGs) or Alternate Control Techniques (ACTs) issued by EPA.

[1] Since CO's role in forming ozone is relatively insignificant, the CAAA does not specify requirements on CO emission reductions regarding attainment of the ozone standard.

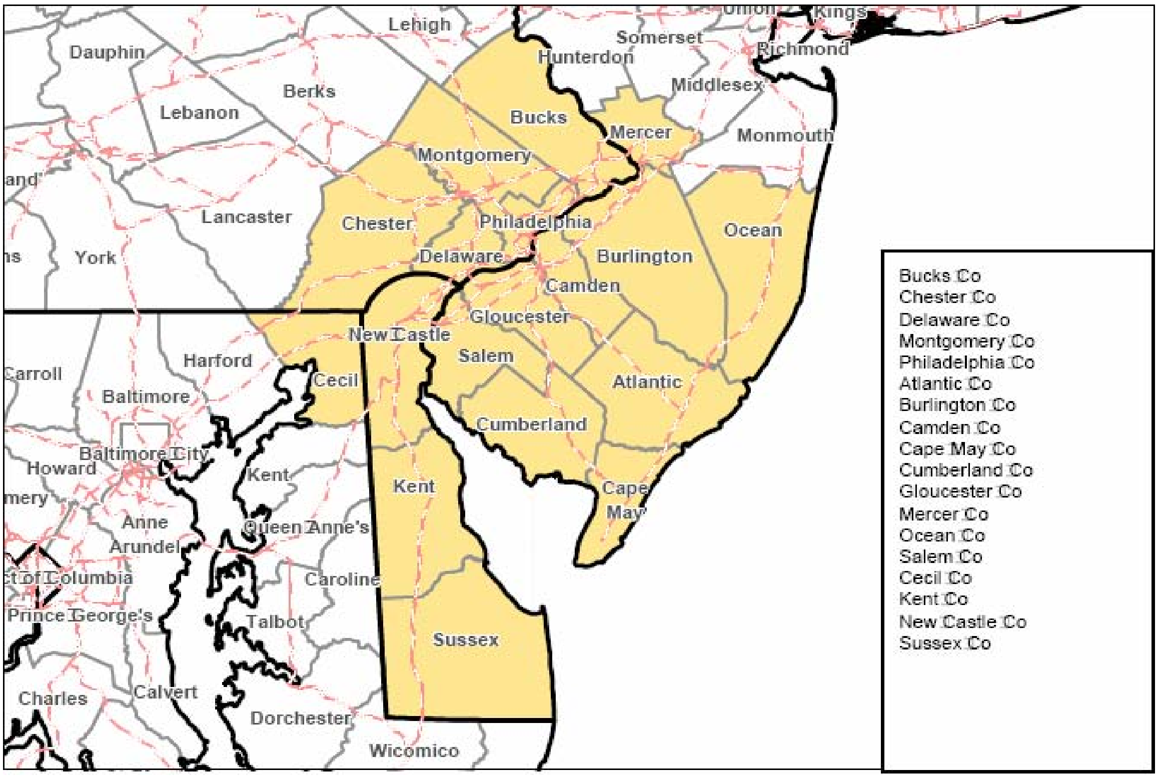

Figure 1-1. Philadelphia-Wilmington-Atlantic City, PA-DE-MD-NJ Moderate Non-Attainment Area for the 8-Hour Ozone NAAQS

Under the 8-hour ozone NAAQS, the entire state of Delaware (i.e., all three counties) is a part of the Philadelphia moderate NAA, and is therefore subject to the CAAA's RACT control requirements. Delaware has addressed all these RACT requirements in its RACT SIP revision, which was submitted to EPA in September 2006, and is pending EPA review and approval (Reference 1-1).

In addition, Section 182(b)(1) of the CAAA requires that all moderate non-attainment areas for ozone achieve "Reasonable Further Progress (RFP)" toward attainment of the ozone NAAQS. In September 2005, EPA issued "Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard-Phase 2" (*70 FR 71612*, hereafter referred to as the Phase 2 Rule)[2]. The Phase 2 Rule specifies the requirements for a non-attainment area to meet the CAAA's RFP provisions. For the moderate non-attainment areas, such as Delaware within the Philadelphia NAA, the requirements include:

(1) Between 2003 and 2008, to implement adequate emission controls that will lead to a total of 15% reduction in VOC emissions from the 2002 levels.

[2] On December 22, 2006, the US Court of Appeals for the District of Columbia Circuit ordered EPA to come up with new enforcement plan for implementing the 8-hour ozone standard. It should be pointed out that this SIP revision is to follow the relevant CAA provisions and to meet the minimum CAA requirements for attaining the 8-hour ozone standard. This SIP revision may need to be updated, depending on how the EPA responds to the court decision.

(2) In 2009-2010, to implement adequate emission controls that will lead to additional emission reductions to be needed for attainment. Based on the definition of attainment year and its ozone season under the 8-hour ozone standard, these additional emission reductions must be achieved prior to the ozone season of 2009 (i.e., before May 1, 2009).
(3) The NAA must demonstrate, through regional air quality modeling and weight-of-evidence analysis, that with the emission reductions meeting the above 2 requirements the NAA will successfully attain the 8-hour ozone standard in the attainment year.

This document demonstrates how Delaware plans to meet the RFP requirements in (1) and (2) above, and the attainment requirements in (3) above. In addition, Delaware ozone monitoring data in 2003, 2004, 2005 and 2006 have shown that the entire state of Delaware, and the entire Philadelphia NAA, has attained the 1-hour ozone NAAQS (see Section 2 of this document). The control measures in this ozone SIP revision also serve as maintenance measures for maintaining the attainment status of the 1-hour ozone standard in Delaware.

Also, before designation as a moderate nonattainment area for the 8-hour standard, Kent and New Castle Counties in Delaware were classified as a “severe” nonattainment area for the 1-hour ozone standard. Clean Air Act Section 182(d) requires severe nonattainment areas to include a number of planning requirements that are more stringent than those required for moderate non-attainment areas. For Kent and New Castle Counties, the more stringent requirements that remain in force under the 8-hour ozone standard include:

(1) A lower major source NOX and VOC threshold for point sources of 25 tons per year (TPY).
(2) A requirement for new or expanding major sources to offset increased emissions by 1.3-to-1.

In addition, under Section 184 of the CAAA, Sussex County was treated as a moderate nonattainment area under the 1-hour ozone standard. As such the major source threshold for VOC is 50 TPY, for NOX is 100 TPY, and an offset requirement of 1.15-to-1 is in place. Based on this, the non-attainment new source review requirements of the CAA are met for Delaware through the requirements of existing Delaware Air Pollution Control Regulation No. 25 (Preconstruction Review, Reference 1-2).

It should be pointed out that while only the control measures that produce post-2002 emission reductions are specifically creditable towards 8-hour ozone reasonable further progress (RFP) and attainment demonstration (AD), and thus included in this SIP revision (see Section 6 of this document), all of the control measures identified in Delaware’s previous SIP revisions under the 1-hour ozone standard will remain as valid and necessary measures to aid in the attainment and maintenance of both the 1-hour and the 8-hour ozone NAAQS. For a complete review of the 1-hour ozone control measure, please see References 2-1, 2-2 and 2-3.

To prevent significant contribution to the ozone non-attainment or interference with maintenance of the ozone standard in downwind states, Delaware has adequate provisions in its ozone SIP revisions and regulations, including both pre- and post-2002 measures, and under the Federal Implementation Plan (FIP). For a complete review of the relevant provisions, please see References 2-1, 2-2 and 2-3.

In addition, both Delaware's air permitting regulations (e.g., Regulations #2, #25 and #30, Reference 1-2) and Delaware state law (7 Del. Code, Chapter 60) provide the Secretary of the Department of Natural Resources and Environmental Control (DNREC) with the authority to take enforcement action, and to issue orders to any person violating any rule, regulation or order or permit condition or provision of the statue to cease and desist from such violation.

1.2 Responsibility

The agency with direct responsibility for preparing and submitting this document is Delaware Department of Natural Resources and Environmental Control (DNREC), Division of Air and Waste Management, Air Quality Management Section (AQMS), under the Section Administrator, Ali Mirzakhalili. The working responsibility for Delaware's air quality planning falls within AQM's Planning Branch, under the Program Manager, Ronald Amirikian. The Air-Shed Evaluation and Planning (AEP) Program within the Planning Branch is instrumental in completing this document, with supporting staff from other branches of AQM. Specifically,

- Frank F. Gao, Ph. D., and P.E., Engineer, is the project leader, and principal author of this SIP revision;
- Mohammed A. Majeed, Ph.D. and P.E., Engineer, is the principal author of Section 7 of this SIP revision;
- David F. Fees, P.E., Program Manager, AQMS Emission Inventory Program, is the supporting lead for the 2002 base year emission inventory;
- Betsy Frey, Scientist, is the supporting lead for ozone monitoring data and trend analysis;
- Phillip A. Wheeler, Planner, is the supporting lead for the on-road mobile source emission projections, and in charge of transportation conformity part;
- Jack L. Sipple and Mark Prettyman, Scientists, are the coordinator and supporting staff for future-year emission projection inventories.

Specific responsibilities of other programs, agencies and contractors will be explained in the relevant sections of this document.

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1-2. *Regulations Governing the Control of Air Pollution*, Air Quality Management Section, Division of Air and Waste Management, Delaware Department of Natural Resources and Environmental Control, Dover, Delaware, as of December 2006.

2. Ozone Air Quality Status and Trends Analysis

2.1 Delaware Ozone Monitoring Network

Delaware set up its ambient ozone monitoring network in late 1980s under the 1-hour ozone standard. The network was modified and approved by EPA in 1995 for meeting the then-upcoming 8-hour ozone standard. The current network for monitoring ambient ozone concentrations under the 8-hour ozone NAAQS contains 6 monitors, with 3 monitors in New Castle County, 1 monitor in Kent County and 2 monitors in Sussex County. Figure 2-1 shows the locations of these monitors. Delaware maintains and operates the network to measure ambient ozone levels within Delaware for comparison to NAAQS. All data is measured using U.S. EPA approved methods. The data is submitted to EPA's Air Quality System (AQS) in a timely manner in accordance to the schedule prescribed by EPA.

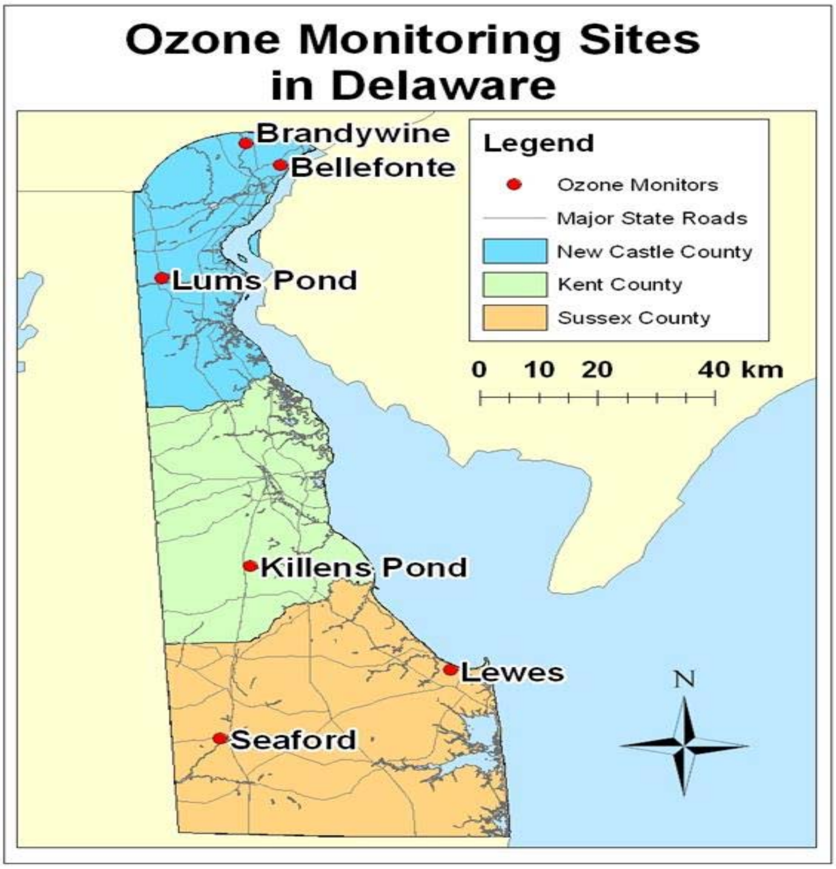

Figure 2-1. Delaware Ozone Monitoring Network for 8-Hour Ozone NAAQS

2.2 Attainment of 1-Hour Ozone Standard

Under the previous 1-hour ozone NAAQS, Delaware's Kent and New Castle Counties were designated as severe non-attainment areas, while Sussex County was a marginal non-attainment area; and the whole state was a part of an ozone transport region established under Section 184 of the CAAA. Section 181 of CAAA required Delaware to attain the 1-hour ozone standard in Sussex County by 1993 and in Kent and New Castle Counties by 2005. To meet this requirement, Delaware implemented numerous controls to reduce VOC and NOx emissions from all sources sectors in Delaware (References 2-1, 2-2 and 2-3). As a result of those control measures, measures implemented nationally by EPA, and measures taken by upwind states, Delaware' ambient air quality relative to ozone has improved significantly.

Table 2-1 shows the number of exceedance days of the 1-hour ozone standard for all three counties in Delaware from 2004 to 2006. Table 2-2 presents the 1-hour ozone design values for all three counties. Data in Table 2-1 and Table 2-2 are based on actual monitoring records. According to CAAA's definition of 1-hour design values and requirement for attaining the 1-hour ozone standard, data in Table 2-1 and Table 2-2 indicate clearly that Delaware's three counties attained the 1-hour ozone standard in 2005, and maintained the 1-hour standard in 2006.

Table 2-1. Number of Days with Exceedance of 1-Hour Ozone Standard

Year	Kent	New Castle	Sussex
2003	1	1	2
2004	0	0	0
2005	0	2	0
2006	0	0	0

Table 2-2. The 1-Hour Ozone Design Values (ppm) of Delaware's Counties

Period	Kent	New Castle	Sussex
2003-2005	0.107	0.109	0.112
2004-2006	0.101	0.104	0.103

Data obtained from EPA's national database for air monitoring data, Air Quality System (AQS), indicates that other counties within Philadelphia Consolidated Metropolitan Statistical Area (CMSA) are in the same attainment status with respect to the 1-hour ozone standard (Reference 2-4). Table 2-3 presents the 1-hour ozone design values for counties in Maryland within the Philadelphia CMSA, Table 2-4 presents the 1-hour ozone design values for counties in Pennsylvania within the Philadelphia CMSA, and Table 2-5 presents the 1-hour ozone design values for counties in New Jersey within the Philadelphia CMSA. Data in Tables 2-1 through Table 2-5 indicate clearly that the entire Philadelphia CMSA attained the 1-hour ozone standard in 2005, and maintained the 1-hour standard in 2006.

Table 2-3. The 1-Hour Ozone Design Values (ppm) of Maryland County in Philadelphia CMSA

Period	Cecil
2003-2005	0.107
2004-2006	0.101

Table 2-4. The 1-Hour Ozone Design Values (ppm) of New Jersey Counties in Philadelphia CMSA

Period	Camden	Cumberland	Gloucester	Mercer	Burlington	Salem
2003-2005	0.107	0.109	0.112	0.107	0.109	0.112
2004-2006	0.101	0.104	0.103	0.101	0.104	0.103

Table 2-5. The 1-Hour Ozone Design Values (ppm) of Pennsylvania Counties in Philadelphia CMSA

Period	Bucks	Chester	Delaware	Montgomery	Philadelphia
2003-2005	0.109	0.112	0.107	0.109	0.112
2004-2006	0.104	0.103	0.101	0.104	0.103

2.3 Delaware 8-Hour Ozone Design Values

In April 2004, EPA designated the 8-hour ozone non-attainment areas based on design values of individual counties within each area. Under the 8-hour ozone standard (0.08 ppm), the design value of a specific county is defined as the highest three-year average of the 4th highest daily 8-hour maximum. The average is calculated as a ppm value truncated at three decimal places. Where there is more than one monitor in a county, the highest calculated value becomes the design value for that county. The EPA's designations for the 8-hour ozone NAAQS non-attainment areas in April 2004 were based on individual counties' 2001-2003 design values.

In the early 2000's Delaware's ozone monitoring data indicated that Delaware's air quality did not meet the 8-hour ozone NAAQS. Table 2-6 summaries the 8-hour ozone design values of the three counties in Delaware starting with the 2000-2002 period. Based on the 2001-2003 design values, EPA designated in 2004 all three counties in Delaware as moderate non-attainment for the 8-hour ozone NAAQS, within the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE moderate non-attainment area.

Table 2-6. Delaware 8-Hour Ozone Design Values by County

Years	New Castle	Kent	Sussex
2000 - 2002	0.096	0.092	0.094
2001 - 2003*	0.094	0.089	0.091
2002 - 2004	0.089	0.084	0.085
2003 - 2005	0.082	0.080	0.084
2004 - 2006	0.082	0.080	0.084

*Design values used by EPA in April 2004 non-attainment designation.

2.4 Ozone Exceedances at Delaware Monitors

Delaware began recording the 8-hour ozone exceedances at its ambient monitors in 1996 (1997 at the monitor at Lewes station). An exceedance is recorded at a monitoring site when the daily maximum 8-hour average, rounded to two decimals, is greater than the standard of 0.08 ppm. Table 2-7 summarizes the number of exceedances at all Delaware monitors from 1996 to 2006. Figure 2-2 is graphical representation of the ozone exceedances (i.e., the data in Table 2-7), which clearly shows a decreasing trend. Since there is no averaging across years, it also shows the variability between years, likely due to variation in both emissions and meteorological conditions. For example, there are a lower number of exceedances associated with the cooler and/or wetter summers of 1996, 2000 and 2004. On contrast, a higher number of exceedances in 2002 were likely associated with a hotter-than-average summer in that year. In addition, the EPA NOx SIP call went into effect in 2003, and resulted in significant reduction in NOx emissions from upwind power plants.

Table 2-7. Number of Days Exceeding 8-hour Ozone NAAQS at Individual Monitors

Year	New Castle County			Kent County	Sussex County	
	Brandywine	Bellefonte	Lums Pond	Killens Pond	Seaford	Lewes
1996	4	3	5	8	5	-*
1997	17	6	15	14	14	14
1998	17	8	12	17	16	17
1999	16	10	12	13	17	17
2000	7	4	5	5	5	6
2001	15	7	9	8	4	10
2002	18	14	9	10	10	14
2003	3	3	4	3	4	4
2004	3	1	0**	0	0	2
2005	3	4	6	2	3	7
2006	2	1	2	4	1	3

*Not monitored in 1996; **No data recorded in July 2004.

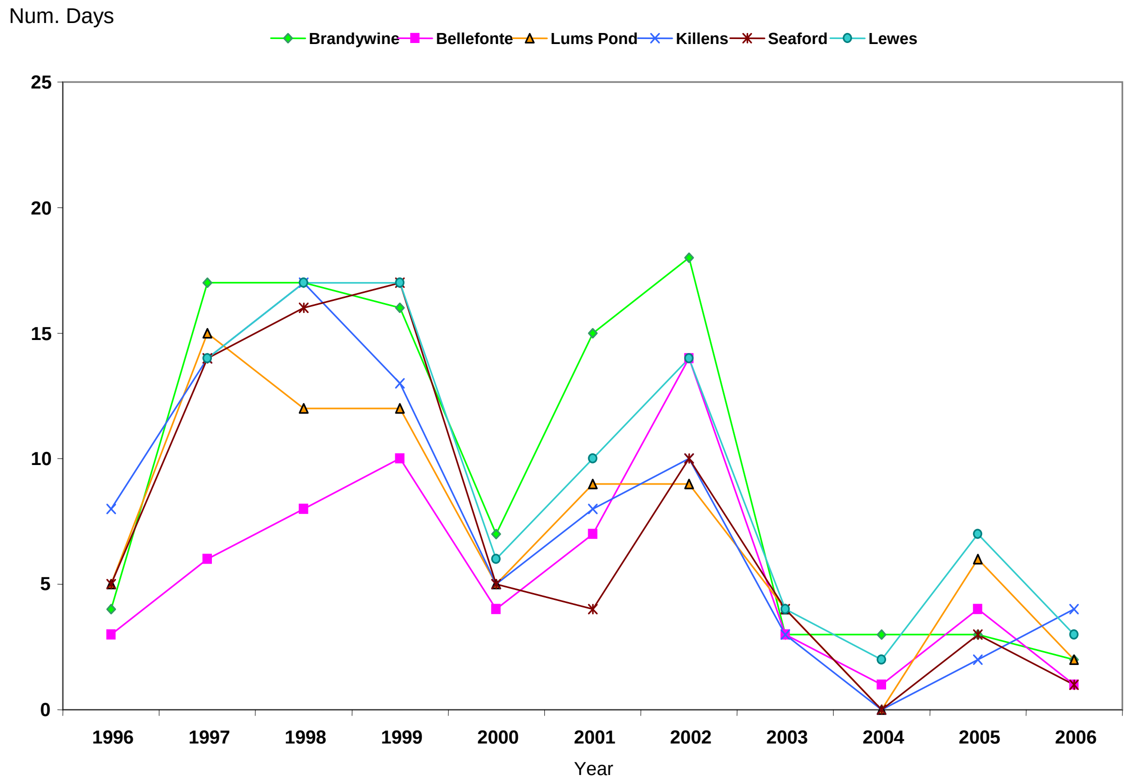

Figure 2-2. Number of 8-hour Ozone Exceedance Days at Monitors

From Table 2-7 and Figure 2-2, it can be seen that the numbers of ozone exceedances in Delaware have shown a decreasing trend in the past decade. In the late 1990s and early 2000s, a majority of Delaware monitors showed a double-digit number of ozone exceedance days. In the last four years, however, all monitors showed a single-digit number of exceedance days.

2.5 Monitored Ambient Ozone Concentration Trends

Table 2-8 provides a summary of the ambient ozone concentrations monitored at individual Delaware monitors from 1996 to 2006. The data in Table 2-8 are presented in terms of design values (i.e., three-year averages of annual 4th highest 8-hour daily concentrations). Using design values has some advantages. First, the three-year average values account for some of the meteorological variability between individual years, which are thus useful in detecting general trends in ambient ozone concentrations**.** Second, since attainment or non-attainment status will be determined by the design values, the trend of the design values can represent a direction towards future attainment status. Figure 2-3 is a graphical representation of the data in Table 2-8. The data in Table 2-8 and Figure 2-3 shows a trend in the ozone design values approaching attainment at all Delaware monitors, in particular, after 2001-2003 period.

Table 2-8. The 8-Hour Ozone Design Values for All Delaware Monitors from 1994 to 2006

Years	New Castle County			Kent County	Sussex County	
	Brandywine	Bellefonte	Lums Pond	Killens Pond	Seaford	Lewes
1994 - 1996	-*	0.094	0.098	-*	0.088	-*
1995 - 1997	0.093	0.094	0.099	0.094	0.093	-*
1996 - 1998	0.094	0.084	0.094	0.096	0.097	-*
1997 - 1999	0.099	0.089	0.099	0.099	0.099	0.099
1998 - 2000	0.096	0.090	0.097	0.097	0.098	0.095
1999 - 2001	0.095	0.091	0.097	0.093	0.095	0.090
2000 - 2002	0.096	0.092	0.096	0.092	0.094	0.087
2001 - 2003	0.093	0.094	0.093	0.089	0.091	0.088
2002 - 2004	0.089	0.085	0.084**	0.084	0.085	0.085
2003 - 2005	0.082	0.082	0.080**	0.080	0.082	0.084
2004 - 2006	0.082	0.081	0.078**	0.080	0.080	0.082

*Data not enough for calculating design values; **No data recorded in July 2004.

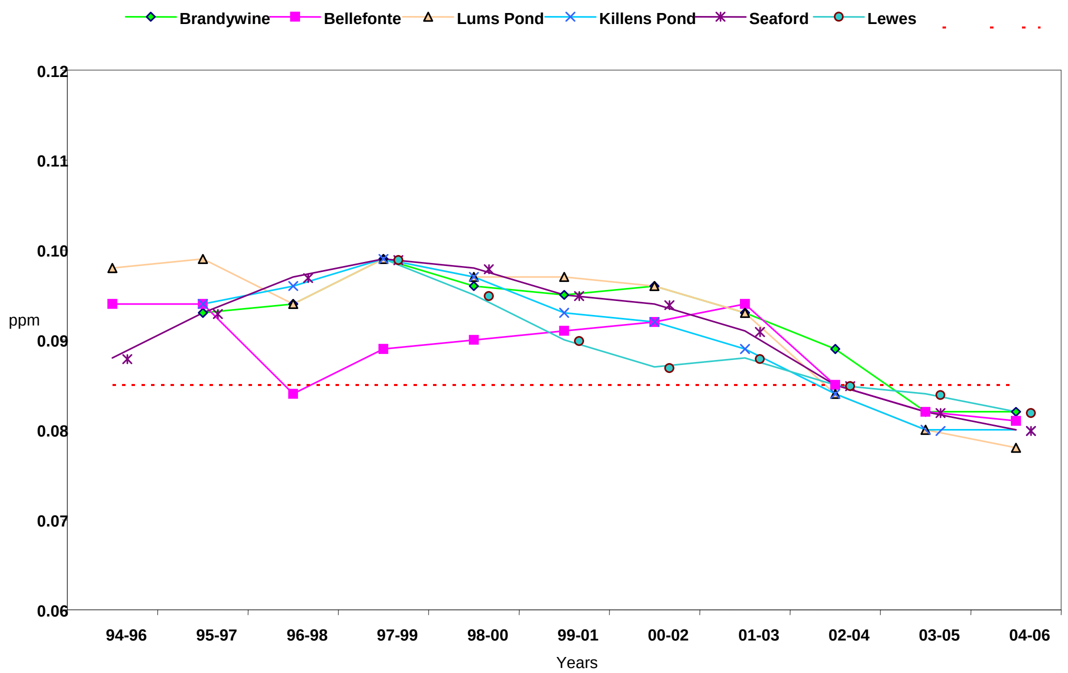

Figure 2-3. Ozone 8-hour Design Values for Individual Monitors

2.6 Meteorological Analysis

Many meteorological factors affect the formation of ground level ozone. One major factor is the ambient temperature during the ozone season. One way of incorporating meteorology in evaluating trends in ozone concentrations is to analyze the number of ozone exceedances, the number of days with temperatures equal to or greater than 90°F, and the ratio of the two numbers. Table 2-9 shows this set of data for Delaware from 1996 through 2006. It should be noted that the temperature data in Table 2-9 are from New Castle County only (Data from New Castle Municipal Airport), while the number of exceedance days are for the entire state (i.e., all three counties). It can be reasonably assumed that the temperature profile for the entire state be similar to that of New Castle County.

Table 2-9. Delaware 8-Hour Ozone NAAQS Exceedances with Respect to Hot Summer Days

Year	# Day Temp. >= 90°F	# Days Exceedances	Ratio
1996	7	6	0.86
1997	20	19	0.95
1998	16	21	1.31
1999	35	18	0.51
2000	8	8	1.00
2001	9	18	2.00
2002	32	18	0.56
2003	10	5	0.50
2004	1	3	3.00
2005	20	8	0.40
2006	21	2	0.10
		Average Ratio	**1.02**

An average ratio that is close to one in Table 2-9 can be seen as one type of index of a direct relationship between temperature and ozone exceedances in the long term. This relationship indicates that more ozone exceedances usually occur in years with more hot summer days, such as 1997, 1998, 1999, and 2002 where both exceedance numbers and hot-day numbers are in the double digits (≥10). Similarly, fewer ozone exceedances occur in years with fewer hot summer days, such as 1996, 2000, and 2004, where both exceedance numbers and hot-day numbers are single digits (<10). In contrast to this general relation, both 2005 and 2006 have high numbers of hot summer days but low numbers of ozone exceedances, making their ratios very low. One explanation for these low ratios is that under the same ozone-favoring meteorological conditions (i.e., high ambient temperatures), recent changes in other conditions have occurred that work against ozone formation. One likely change would be a decrease in concentrations of ozone forming precursors (i.e., VOC and/or NOx) in the ambient air.

2.7 General Trend of Ambient Air Quality Regarding 8-Hour Ozone

From the data presented in this section, it is clear that the general trend of ambient ozone air quality in Delaware is continuously improving, especially in the past 3 years. In summary:

(1) Numbers of the 8-hour ozone exceedances at all Delaware monitors show a clear decreasing trend (Table 2-7 and Figure 2-2);
(2) Ambient ozone concentrations recorded at all Delaware monitors show a clear downward trend (Table 2-8 and Figure 2-3);

(3) Ratios of ozone exceedances versus hot summer days in 2005 and 2006 lead to an apparent downward trend in the future years (Table 2-9).

References

2-1. *Regulations Governing the Control of Air Pollution*, Air Quality Management Section, Division of Air and Waste Management, Delaware Department of Natural Resources and Environmental Control, Dover, Delaware, as of December 2006.

2-2. *Delaware 2005 Rate-of-Progress Plan for Kent and New Castle Counties, For Demonstrating Progress toward Attainment of the 1-Hour National Ambient Air Quality Standard for Ground-Level Ozone*, Department of Natural Resources and Environmental Control, Dover, DE, December 2000.

2-3. *Measures to Meet the EPA-Identified Shortfalls in the Delaware Phase II Attainment Demonstration for the Philadelphia-Wilmington-Trenton Ozone Non-Attainment Area*, Department of Natural Resources and Environmental Control, Dover, DE, July 2001.

2-4. *Air Quality System, National Database for Air Monitoring Data*, US Environmental Protection Agency, at http://www.epa.gov/ttn/airs/airsaqs/index.htm.

3. Delaware 2002 Base Year Emissions Inventory

Under the 8-hour ozone NAAQS, EPA requires the non-attainment areas to compile a 2002 base year VOC/NOx emission inventory as the baseline for RFP emission reduction analysis toward attainment, but allows states the option of justifying the use of an alternative base year (Phase 2 Rule, *70 FR 71612*). Delaware has used the year 2002 as its base year.

Compilation of Delaware's 2002 base year emission inventory was conducted by AQMS' Emission Inventory Development (EID) Program. The development of the 2002 emission inventory was governed by a Quality Assurance Project Plan (QAPP) prepared by EID (Reference 3-1). Due to a staffing shortage of the EID group, AQMS contracted with E.H. Pechan and Associates (hereafter referred to as Pechan) based in Durham, North Carolina, to develop portions of the 2002 base year inventory, under close direction of the EID program manager. Methods of developing the 2002 base year inventory are briefly described herein, while details are presented in the QAPP and Delaware 2002 Base Year Emission Inventory (Reference 3-2).

It should be pointed out: (1) The 2002 base year emission inventory has been compiled to serve Delaware for this ozone SIP, for a particulate matter (PM) attainment demonstration SIP and a regional haze SIP that are now under development, and for air toxics assessments; therefore contains emissions data for VOC, NOx, carbon monoxide (CO), PM, sulfur dioxide (SO_2), ammonia (NH_3) and all Hazardous Air Pollutants (HAPs). Since this document is solely an ozone SIP revision, it will discuss only the two major ozone precursors, i.e., VOC and NOx. (2) Although CO is considered an ozone precursor, its contribution to ozone formation is believed to be insignificant, and the CAAA does not require consideration of CO emissions in the ozone attainment planning process. Therefore, CO emission data will not be discussed in this document. (3) Although biogenic source emissions (VOC and NOx) and NOx emissions due to lightning are included in the 2002 base year inventory, the CAAA does not require inclusion of these natural sources of emissions in the ozone SIP development. Therefore, these natural emissions are not discussed in this document. (4) The 2002 base year VOC emissions do not contain emissions of pollutants that are defined by EPA as non-reactive in ozone formation (e.g., perchloroethylene (PERC)).

3.1 Point Source Sector

The emission inventory of this sector has been developed by the EID's point source technical lead and supporting staff. Under CAAA and EPA's Phase 2 Rule (*70 FR 71612*), the minimum requirements for Delaware to include in the point source sector are (1) all Title V permitted facilities, (2) in Kent County and New Castle County, facilities that have a facility-wide annual VOC emission of 25 tons or greater, or a facility-wide annual NOx emission of 25 tons or greater, (3) in Sussex County, facilities that have a facility-wide annual VOC emission of 100 tons or greater, or a facility-wide annual NOx emission of 100 tons or greater, and (4) all electric generating facilities. For consistency, however, Delaware has modified criteria (2) and (3) by setting lower thresholds for VOC and NOx sources as follows: 5 tons per year (TPY) or greater for VOC emission sources, and 25 TPY or greater for NOx emission sources. A list of all point source facilities in the 2002 base year inventory is presented in Table 3-1.

Table 3-1. Point Source Facilities in Delaware 2002 Base Year Inventory

#	Facility Location	Facility ID	Facility Name
1	**Kent County, DE**	00026	BAYHEALTH MED CENTER KENT GENERAL HOSP
2		00099	CAMDEL METALS CORPORATION
3		00002	CITY OF DOVER - MCKEE RUN GENERATING STA
4		00076	CITY OF DOVER VAN SANT GENERATING STA
5		00121	COLOR-BOX LLC
6		00068	DE SOLID WASTE AUTHORITY SANDTOWN
7		00066	DELAWARE STATE UNIVERSITY
8		00001	DOVER AIR FORCE BASE
9		00016	DOW REICHHOLD SPECIALTY LATEX LLC
10		00024	HANOVER FOODS CORPORATION
11		00012	HARRIS MANUFACTURING CO INC
12		00067	HIRSH INDUSTRIES
13		00011	ILC DOVER INC.
14		00007	KRAFT FOODS NORTH AMERICA
15		00127	NRG ENERGY CENTER DOVER LLC
16		00075	PERDUE FARMS INC - MILFORD
17		00004	PROCTOR AND GAMBLE DOVER WIPES COMPANY
18		00006	TILCON DELAWARE - BAY ROAD
19		00014	TILCON DELAWARE - HORSEPOND ROAD
20		00152	WARREN F BEASLEY POWER STATION
21	**New Castle County, DE**	00377	AGILENT TECHNOILOGIES
22		00064	AIR LIQUIDE AMERICA L P
23		00131	ALFRED I DUPONT HOSPITAL FOR CHILDREN
24		00029	AMETEK INC CHEMICAL PRODUCTS DIVISION
25		00288	AMI ASSET ACQUISITION CO
26		00023	AMTRAK WILMINGTON MAINTENANCE FACILITY
27		00059	ARLON, INC.
28		00106	ASTRAZENECA PHARMACEUTICALS LP-FAIRFAX
29		00080	CHRISTIANA CARE - CHRISTIANA HOSPITAL
30		00024	CHRISTIANA CARE - WILMINGTON HOSPITAL
31		00068	CHRISTIANA MATERIALS
32		00003	CIBA SPECIALTY CHEMICALS CORP
33		00063	CLAYMONT STEEL
34		00290	CLEAN EARTH OF NEW CASTLE
35		00317	CONECTIV DELMARVA GENERATION-CHRISTIANA
36		00005	CONECTIV DELMARVA GENERATION-DEL CITY
37		00007	CONECTIV DELMARVA GENERATION-EDGE MOOR
38		00388	CONECTIV DELMARVA GENERATION-HAY ROAD

39	00046	CONECTIV DELMARVA GENERATION-MADISON ST
40	00006	CONECTIV DELMARVA GENERATION-WEST_SUBST
41	00066	CONTRACTORS MATERIALS LLC HOT MIX PLT
42	00128	DAIMLERCHRYSLER CORPORATION
43	00365	DASSAULT FALCON JET-WILMINGTON CORP
44	00111	DE SOLID WASTE AUTHORITY CHERRY ISLAND
45	00086	DE SOLID WASTE AUTHORITY PIGEON POINT
46	00090	DELAWARE CORRECTIONAL CENTER - SMYRNA
47	00415	DELAWARE RECYCLABLE PRODUCTS INC
48	00077	DEPT OF VETERANS AFFAIRS MEDICAL CENTER
49	00069	DIAMOND MATERIALS LLC
50	00126	DUPONT CHESTNUT RUN
51	00010	DUPONT EDGEMOOR
52	00011	DUPONT EXPERIMENTAL STATION
53	00279	DUPONT STINE - HASKELL LABORATORY
54	00049	DUPONT WILMINGTON OFFICE BUILDING
55	00073	E-A-R SPECIALTY COMPOSITES S B U AEARO
56	00040	EDGEMOOR MATERIALS INC
57	00051	FMC BIOPOLYMER
58	00027	FORMOSA PLASTICS CORPORATION
59	00037	FP INTERNATIONAL INC
60	00500	GE ENERGY (USA) LLC
61	00032	GENERAL CHEMICAL CORPORATION
62	00015	GENERAL MOTORS CORPORATION
63	00513	HARDCORE COMPOSITES, DIV. OF HARRIS SPEC
64	00017	HERCULES INCORPORATED RESEARCH CENTER
65	00038	HONEYWELL INTERNATIONAL INC
66	00367	INTERNATIONAL PETROLEUM CORP OF DELAWARE
67	00350	KANEKA DELAWARE CORPORATION
68	00129	LAFARGE NORTH AMERICA INC
69	00028	LAIDLAW CORPORATION
70	00104	MACDERMID INC
71	00291	MAGELLAN TERMINALS HOLDINGS, L.P.
72	00383	MEDAL A DIV OF AIR LIQUIDE ADV TECH US
73	00074	METACHEM PRODUCTS LLC
74	00324	NORAMCO INC
75	00018	NVF COMPANY INC - YORKLYN FACILITY
76	00030	OCCIDENTAL CHEMICAL CORPORATION
77	00016	PREMCOR DELAWARE CITY REFINERY
78	00404	PREMCOR TERMINAL
79	00093	PRINTPACK INC
80	00382	PTFE COMPOUNDS INC
81	00463	PURE GREEN INDUSTRIES INC
82	00033	ROHM & HAAS ELECTRONIC MATERIALS

			CMP TE
83		00381	SPATZ FIBERGLASS PRODUCTS
84		00426	SPI POLYOLS INC
85		00133	ST. FRANCIS HOSPITAL
86		00021	SUNOCO INC MARCUS HOOK REFINERY
87		00092	THE CROWELL CORPORATION
88		00048	TILCON DELAWARE - TERMINAL AVENUE
89		00058	UNIQEMA
90		00067	UNISOURCE WORLDWIDE INC
91		00022	UNIVERSITY OF DELAWARE NEWARK
92		00127	VPI FILM LLC
93		00121	WESTVACO CORPORATION
94		00004	WILMINGTON PIECE DYE CO
95		00389	WILMINGTON WASTEWATER TREATMENT PLANT
96	**Sussex County, DE**	00013	ALLEN FAMILY FOODS INC
97		00016	ALLEN'S HATCHERY INC ALLEN'S MILLING
98		00036	BAYHEALTH MEDICAL CTR - MILFORD MEMORIAL
99		00029	CITY OF LEWES POWER PLANT
100		00108	CITY OF SEAFORD-ELECTRIC POWER PLANT
101		00099	DE SOLID WASTE AUTHORITY SOUTHERN
102		00120	EDWARD J. KAYE CONSTRUCTION
103		00001	INDIAN RIVER GENERATING STATION
104		00002	INVISTA
105		00006	JOHNSON POLYMER INC
106		00066	JUSTIN TANKS LLC
107		00093	MARITRANS
108		00028	MIL-DEL CORPORATION
109		00004	MOUNTAIRE FARMS OF DELAWARE INC-MILLSBOR
110		00073	MOUNTAIRE FARMS OF DELMARVA – SELBYVILLE
111		00012	MOUNTAIRE FARMS OF DELMARVA FRANKFORD
112		00121	MULTI-TECH INC
113		00011	ORIENT CORPORATION OF AMERICA
114		00003	PERDUE FARMS – BRIDGEVILLE
115		00075	PERDUE FARMS INC – GEORGETOWN
116		00146	PERDUE-AGRIRECYCLE LLC
117		00071	PINNACLE FOODS CORPORATION - VLASIC PLNT
118		00009	SEA WATCH INTERNATIONAL LTD
119		00196	THE MARBLE WORKS
120		00130	TILCON DELAWARE – GEORGETOWN
121		00026	TILCON DELAWARE GUMBORO

Each point source facility is required to submit to the EID group a detailed report, which contains all necessary emission-related information for all emission-making processes within the facility's boundary. The required information includes emissions directly measured by continuous emission monitors (CEMs), or activity data that can be used to calculate emissions. The report includes also all information regarding control measures currently (as of 2002) installed on the relevant processes. After quality control and quality assurance (QC-QA) review and necessary revision, EID verifies or determines the annual emissions and summer ozone season daily emissions for each process within a facility. Then, all the process-level emissions are summed up to the facility's total emissions. The final emission data were included in the SIP submission to EPA (Reference 3-2).

3.2 Stationary Non-Point Source Sector

The emission inventory of stationary non-point (or area) source sector has been conducted by Pechan, with technical support from the EID group. This source sector represents a large and diverse set of individual emission source categories. A non-point source category is either represented by small facilities too numerous to individually inventory, such as gasoline stations or print shops, or is a common emission-making activity, such as the use of paints or cleaning solvents. The distinction between point and non-point sources is defined by an annual emission threshold as described in Subsection 3.1 above. Table 3-2 presents a list of all stationary non-point source categories included in Delaware 2002 base year inventory.

Table 3-2. Non-Point Source Categories in Delaware 2002 Base Year Inventory

SCC*	**VOC Emissions Only**	**SCC***	**Emissions of VOC and NO_x**
2461	Agricultural Pesticides	2830	Catastrophic/Accidental Releases
2401	AIM Coatings	2302	Commercial Cooking
2461	Asphalt Paving	2103	Commercial Fuel Combustion
2401	Auto Refinishing	2102	Industrial Fuel Combustion
2302	Bakeries	2302	Land Clearing Debris Burning
2460	Commercial & Consumer Products	2810	Prescribed Burning
2420	Dry Cleaning	2104	Residential Fuel Combustion
2501	Gasoline (Petroleum) Marketing	2610	Residential Open Burning
2505	Gasoline (Petroleum) Marketing**	2104	Residential Wood Combustion
2425	Graphic Arts	2810	Structure Fires
2440	Industrial Adhesives	2810	Vehicle Fires
2401	Industrial Surface Coatings	2810	Wildfires
2620	Landfills (Inactive)		
2660	Leaking Underground Storage Tanks		
2630	Publicly-Owned Treatment Works		
2415	Solvent Cleaning		
2401	Traffic Markings		

*A complete SCC code has 10 digits, with the last 6 digits specifying subcategories.
**For two subcategories, tank trucks in transit and evaporative emissions from transport of petroleum products by commercial marine vessels.

Inventory work in this sector started with collecting relevant activity data by the EID staff members and providing them to Pechan. Pechan's staff in the non-point sector selected appropriate methods, with consultation of the EID manager and supporting staff, for emission calculations. After two rounds of QC-QA reviews and revision by Pechan's staff and EID staff, the emission data were finalized, and included in the final SIP submission to EPA (Reference 3-2).

3.3 Non-Road Mobile Source Sector

The emission inventory of the non-road mobile source sector has been conducted by Pechan, with technical support from the EID staff. This sector includes (1) non-road vehicles that are not covered by on-road mobile sector (as described in Section 3.4 of this document), and (2) moving equipment. The non-road vehicles and equipment are grouped into the following four subcategories for the purpose of developing emission estimates:

(1) Aircraft – Commercial, military, and private aircrafts;
(2) Locomotives – Commercial line haul and yard locomotives;
(3) Commercial Marine Vessels (CMVs) – Various types of vessels that navigate the Delaware Bay and River and the Chesapeake and Delaware Canal (this subcategory does not include recreational boats);
(4) Other Off-road Vehicles and Equipment – including the following:

- Recreational (land-based);
- Construction and Mining;
- Industrial;
- Lawn and Garden;
- Agricultural;
- Commercial;
- Logging;
- Airport Ground Support;
- Recreational Marine; and
- Railway Maintenance.

Inventory work in this sector started with collecting relevant activity data by the EID staff members and providing them to Pechan. Pechan's staff in the non-road sector selected appropriate methods, with consultation of the EID manager and supporting staff, for emission calculations.

Emissions from aircraft, locomotives, and CMVs were calculated using appropriate emission factors and controls as effective in 2002. Emissions of all other non-road sources in subcategory (4) above were estimated using EPA's NONROAD model, which further divided these vehicles and equipment by fuel types, including 2-stroke gasoline, 4-stroke gasoline, diesel, liquefied petroleum gas (LPG), and compressed natural gas (CNG). After two rounds of QC/QA reviews and revision by Pechan's staff and EID staff, the emission data were finalized, and included in the final SIP submission to EPA (Reference 3-2).

3.4 On-Road Mobile Source Sector

The emission inventory of on-road mobile source sector has been conducted by Pechan, with technical support from the EID staff. The on-road mobile sources cover all highway vehicles including passenger cars, light-duty trucks, sport utility vehicles, heavy-duty trucks, buses, and motorcycles, which traveled on Delaware's roadways in 2002.

The AQM mobile sources lead and EID staff gathered the actual vehicle miles traveled (VMT) on Delaware's roadways and vehicle mix data from the Delaware Department of Transportation (DelDOT), and summarized all information about control measures effective in 2002. With the vehicle mix data and control information, Pechan used EPA's MOBILE6.2 model to generate emission factors for each vehicle type traveling on each of the 11 functional road classes. The emission factors and the VMT data were then used to calculate VOC and NOx emissions for each vehicle type on each road class. The end products of the calculations are sums of VOC and NOx emissions for all vehicles on all road classes in each of the three counties in Delaware. After two rounds of QC/QA reviews and revision by Pechan's staff and EID staff, the emission data were finalized, and included in the final SIP submission to EPA (Reference 3-2).

3.5 Delaware 2002 Base Year Emission Inventory Summary

Table 3-3 and Table 3-4 present a summary of Delaware 2002 base year VOC and NOx emissions. Since biogenic source emissions are not required in the ozone RFP planning, they are not included in the tables.

Table 3-3. Delaware 2002 Base Year VOC Emissions in Tons per Day

Source Sector	Kent	New Castle	Sussex	State Total
Point	0.49	9.42	13.35	23.26
Stationary Area	5.75	20.02	7.31	33.08
Non-Road Mobile	5.17	12.24	9.36	26.77
On-Road Mobile	5.45	16.98	9.95	32.38
Total Emissions	**16.86**	**58.66**	**39.97**	**115.49**

Table 3-4. Delaware 2002 Base Year NOx Emissions in Tons per Day

Source Sector	Kent	New Castle	Sussex	State Total
Point	5.06	44.09	24.95	74.10
Stationary Area	0.45	1.95	0.77	3.17
Non-Road Mobile	15.02	24.62	13.15	52.79
On-Road Mobile	13.97	36.56	18.50	69.03
Total Emissions	**34.50**	**107.22**	**57.37**	**199.09**

References

3-1. *Quality Assurance Project Plan for 2002 Base Year Ozone State Implementation Plan Emission Inventory for VOCs, NOx, and CO for the State of Delaware*, Delaware Department of Natural Resources and Environmental Control, Air Quality Management Section, Dover, Delaware, January 2007.

3-2. *The 2002 Base Year Ozone State Implementation Plan Emission Inventory for VOCs, NOx, and CO for the State of Delaware*, Delaware Department of Natural Resources and Environmental Control, Air Quality Management Section, Dover, Delaware, June 2007.

4. Emission Reduction Requirements for RFP and Attainment

4.1 Adjustments of 2002 Base Year Emission Inventory

As mentioned in Section 1 of this document, Delaware must achieve specific emission reductions in the period of 2003-2008 and 2009-2010 to meet the CAAA RFP requirements and to demonstrate attainment of the 8-hour ozone standard. According to EPA's guidance (Reference 4-1) and the Phase 2 Rule (*70 FR 71612*), the 2002 base year inventory must be adjusted for non-creditable emission reductions before the required emission reductions are calculated. Details of this adjustment are described below.

Step 1. Development of 2002 Baseline Inventory

The 2002 Baseline Inventory is defined as an inventory accounting for only anthropogenic emissions within Delaware state boundaries. This baseline inventory shall not include, (1) natural emissions, (2) any emissions from sources outside Delaware, and (3) the non-reactive perchloroethylene (PERC) emissions (for VOC inventory only). From the discussion in Section 3 of this document, it can be seen that Delaware's 2002 Base Year VOC and NOx emissions (Table 3-3 and Table 3-4) meet the condition of baseline inventory. Therefore, the 2002 Base Year anthropogenic Inventory is the 2002 Baseline Inventory

Step 2. Calculations of Mobile Source Adjustments

According to Section 182(b)(1)(D) of the CAAA, emission reductions that resulted from the Federal Motor Vehicle Control Program (FMVCP) and Reid Vapor Pressure (RVP) rules promulgated prior to 1990 are not creditable for achieving RFP emission reductions. Therefore, the 2002 Baseline Inventory needs to be adjusted by subtracting the VOC and NOx emission reductions that are expected to occur between 2002 and future milestone years due to the FMVCP and RVP rules.

The FMVCP/RVP VOC and NOx emission reductions that are expected to occur between 2002 and 2008 were determined using EPA's MOBILE6.2 model. Based on the Phase 2 Rule and the guidance from EPA Region 3 Office (Christopher Cripps, personal correspondence), AQM's mobile source staff members conducted two MOBILE6.2 runs as follows:

(1) Running MOBILE6.2 with 2002 as evaluation year and the adjusted input conditions with: 1990 I/M programs (as they were in 1990 if any), without using "fuel program" command to turn-on the appropriate RFG program, setting the RVP to the same value used for the 1-hour plans (i.e., 9.0 psi, as required by the June 1990 rule, 40 CFR 80.27(a)(2)), using NO TIER 2, NO 2007 HDDV RULE and NO CLEAN AIR ACT commands. Then, using the obtained emission factors and the 2002 VMTs to compute an "adjusted 2002 on-road inventory."
(2) Running MOBILE6.2 with 2008 as evaluation year and the same adjusted input conditions as in (1). Then, using the obtained emission factors and the 2002 VMTs to compute an "adjusted 2008 on-road inventory."
(3) Computing the difference between the above two "adjusted on-road inventory" to obtain the mobile source 2008 adjustment to the 2002 baseline inventory.

The input and output files of the MOBILE6.2 runs for the above adjustments, the emission factors generated and relevant calculations for emission projections are presented in Appendix 4-1.

For the period between 2002 and the 2010 attainment year, steps (2) and (3) above were conducted. According to EPA's Final Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard-Phase 1 (*69 FR 23951*, hereafter referred to as the Phase 1 Rule), emission reductions for the 2010 attainment year must be implemented by the beginning of the ozone season immediately preceding the attainment year. In other words, emission reductions for the attainment must be achieved before May of 2009. Therefore, instead of using 2010 as the evaluation year in step (2) above, the year 2009 was used.

The results of MOBILE6.2 runs for the above adjustments are presented in Table 4-1 for Sussex County and in Table 4-2 for Kent and New Castle Counties. The fleet turnover corrections between 2008 and 2009 are also calculated in Table 4-1 and Table 4-2.

Table 4-1. Mobile Source FMVCP/RVP Adjustments for Sussex County

Adjusted On-Road Mobile Source Emissions	**VOC**	**NOx**	**Note**
Adjusted for 2002	16.66	20.24	A
Adjusted for 2008	15.51	18.81	B_{2008}
Adjusted for 2009	15.48	18.71	B_{2009}
Mobile Source Adjustments for 2002 Baseline			
For 2002-2008	1.15	1.42	$C_{2008} = A-B_{2008}$
For 2002-2009	1.18	1.53	$C_{2009} = A-B_{2009}$
Fleet Turnover Corrections for 2008-2009	0.03	0.10	$D = C_{2009}-C_{2008}$

Table 4-2. Mobile Source FMVCP/RVP Adjustments for Kent/New Castle Counties

Adjusted On-Road Mobile Source Emissions	**VOC**	**NOx**	**Note**
Adjusted for 2002	42.16	56.02	a
Adjusted for 2008	39.18	51.64	b_{2008}
Adjusted for 2009	39.13	51.40	b_{2009}
Mobile Source Adjustments for 2002 Baseline			
For 2002-2008	2.98	4.38	$c_{2008} = a-b_{2008}$
For 2002-2009	3.03	4.62	$c_{2009} = a-b_{2009}$
Fleet Turnover Corrections for 2008-2009	0.05	0.24	$d = c_{2009}-c_{2008}$

Step 3. Development of 2002 Adjusted Baseline Inventory

As explained in Step 2 above, the mobile source adjustments in Tables 4-1 and 4-2 are the non-creditable emission reductions due to the pre-1990 FMVCP and RVP rules. Subtracting these adjustments from the 2002 baseline inventory (i.e., the state total emissions in Table 3-3 and Table 3-4) will give the "the 2002 adjusted baseline inventory relative to the subject milestone year," as presented in Table 4-3 for Sussex County and in Table 4-4 for Kent and New Counties.

Table 4-3. The 2002 Adjusted Baseline Inventory for Sussex County

	VOC	NOx	Note
2002 Baseline Emission Inventory	39.97	57.37	E
Mobile Source Adjustments for 2002-2008	1.15	1.42	C_{2008}
Mobile Source Adjustments for 2002-2009	1.18	1.53	C_{2009}
2002 Adjusted Baseline Relative to 2008	38.82	55.95	$F_{2008} = E\text{-}C_{2008}$
2002 Adjusted Baseline Relative to 2009	38.79	55.84	$F_{2009} = E\text{-}C_{2009}$

Table 4-4. The 2002 Adjusted Baseline Inventory for Kent/New Castle Counties

	VOC	NOx	Note
2002 Baseline Emission Inventory	75.52	141.72	e
Mobile Source Adjustments for 2002-2008	2.98	4.38	c_{2008}
Mobile Source Adjustments for 2002-2009	3.03	4.62	c_{2009}
2002 Adjusted Baseline Relative to 2008	72.54	137.34	$f_{2008} = e\text{-}c_{2008}$
2002 Adjusted Baseline Relative to 2009	72.49	137.10	$f_{2009} = e\text{-}c_{2009}$

4.2 Emissions Reductions for 2003-2008 RFP

By the end of 2008, Delaware is required to reduce 15% in its 2002 adjusted baseline emissions. According to the Phase 2 Rule (*70 FR 71612*), Sussex County must achieve this 15% reduction in its VOC emission, since it did not have a 15% VOC Rate-of-Progress (ROP) plan approved by EPA under the 1-hour ozone standard. For Kent and New Castle Counties, their 15% emission reductions can be achieved from VOC emissions and/or from NOx emissions.

(1) 15% VOC Emission Reduction in Sussex County

The 15% VOC emission reduction and emission target in 2008 in Sussex County are calculated as follows.

Sussex 2002 Adjusted VOC Baseline Relative to 2008: 38.82 TPD
Required 15% Emission Reduction: 38.82 x 15% = 5.82 TPD
2008 VOC Emission Target: 38.82 – 5.82 = 33.00 TPD

The next section (Section 5) demonstrates that Sussex County meets this VOC target in 2008.

(2) 15% VOC Emission Reductions in Kent/New Castle Counties

The 15% VOC emission reduction and emission target in 2008 in Kent and New Castle Counties are calculated as follows.

Kent/New Castle 2002 Adjusted VOC Baseline Relative to 2008: 72.54 TPD
Required 15% Emission Reduction: 72.54 x 15% = 10.88 TPD
2008 VOC Emission Target: 72.54 – 10.88 = 61.66 TPD

The next section (Section 5) demonstrates that Kent and New Castle Counties meet this VOC target.

4.3 Emissions Reductions for Attainment Year

According to the Phase 2 Rule (*70 FR 71612*), all VOC and/or NOx emission reductions for attainment must be achieved prior to the ozone season of 2009, instead of 2010. In addition, both VOC and NOx emission reductions can be used in the entire state to meet the reduction requirements. Section 7 of this document discusses reductions needed for attainment. According to Section 7 of this document, the modeling performed by NY DEC of a 2009 MANE-VU OTB/OTW inventory, and a WOE analysis shows that attainment will be reached both in Delaware and in the entire PA-NJ-DE-MD area in 2009. That modeling and WOE analysis in Section 7 include~~d~~ MANE_VU 2009 emission projections from Delaware at the following levels, which are therefore the emission targets in 2009 to attain the 8-hour ozone standard:

Delaware VOC Emission Target in 2009:	85.04 TPD
Delaware NOx Emission Target in 2009:	147.64 TPD

Reference

4-1. *Guidance on the Adjusted Base Year Emissions Inventory and the 1996 Target for the 15 Percent Rate-of-Progress Plans*, EPA-452/R-92-005, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, October 1992.

5. Control Measures and Emission Reductions for 2003-2008 RFP

According to EPA's Phase 2 Implementation Rule (*70 FR 71612*), Delaware must achieve 15% VOC emission reduction in Sussex County from its 2002 baseline level, and 15% VOC and/or NOx emission reduction in Kent and New Castle Counties from their combined 2002 baseline level, before the end of 2008. Section 6 of this document presents details of control measures that Delaware has adopted and the 2009 emission projections under those controls. In general, because the 2008 milestone year is so close to the 2009 attainment year, the 2008 emission projections in this section are obtained by linear interpolating of the 2002 base year emissions and the 2009 projections, unless otherwise explained. This interpolation method assumes a linear growth in emission between 2002 and 2009, wherever a growth factor is applied for the 2009 projection (See Section 6 of this document), and the same control efficiency (CE), rule effectiveness (RE) and rule penetration (RP) in 2008 and 2009 for the relevant controls.

5.1 Point Source VOC Control Measures and Emission Reductions

5.1.1 Sussex County Point Source Controls and Emission Reductions

The only post-2002 point source VOC control in Sussex County is Regulation No. 24, Section 46, Control of Crude Oil Lightering Operations. The 2008 lightering emissions are projected based on the requirements of Reg. 24, Section 46. Emissions from all other point sources are estimated based on their 2009 projection (see Section 6) and interpolated to 2008 levels.

A. Crude Oil Lightering Operations

Delaware air pollution control Regulation 1124 Section 46 was finalized in May 2007. Table 46-1 of Reg. 1124 Sec. 46 specifies the following allowable uncontrolled VOC emissions from lightering operations:

Beginning on	Maximum allowable uncontrolled lightering volume, expressed as a percentage of a fixed baseline volume, for prior 12-months (rolling total)
May 1, 2008	80 %
May 1, 2010	61 %
May 1, 2012	43%

Assuming a 100% control efficiency (based on vapor balancing control), the above table requires that each lightering operation must achieve VOC emission reductions of 20%, 39%, and 57% by May 1 of 2007, 2009, and 2011, respectively, from its baseline level.

2002 Emission from lightering	= 12.90 TPD
2003-2008 reduction	= 12.90 x 20% = 2.58 TPD
2008 Projection	= 12.90 – 2.58 = 10.32 TPD

B. All Other Sussex Point Sources except Lightering Operation

Since there will be no new VOC controls for these point sources between 2008 and 2009, their 2008 emission reductions and projections are estimated by interpolating the 2002 base year emissions and the 2009 projections, as shown below.

2009 All-point source emission projection	= 7.64 TPD
2009 Lightering emission projection	= 7.26 TPD
2009 All other-point source emission less lightering operation	= 7.64 – 7.26 = 0.38 TPD
2002 All point source emission	= 13.35 TPD
2002 All other-point source emission less lightering operation	= 13.35 – 12.90 = 0.45 TPD
2003-2008 Reduction from other sources	= (0.45 – 0.38) x 6/7 = 0.06 TPD
2008 All other-point source projection	= 0.45 – 0.06 = 0.39 TPD

C. All point sources

2003-2008 Reduction	= 2.58 + 0.06 = 2.64 TPD
2008 All point source projection	= 13.35 – 2.64 = 10.71 TPD

5.1.2 Kent and New Castle Counties Point Source Controls and Emission Reductions

A. Facility and unit shutdown/modification reductions

Emission reduction credits from shutdown facilities and/or units are identical in 2008 and 2009. Table 5-1 is a list of the facilities and/or units that were shutdown after 2002 and by the end of 2008.

Table 5-1. Emission Reductions from Facilities Shutdown after 2002

Facility Name	County	NOX 2002 Total	NOX 2009 Total	VOC 2002 Total	VOC 2009 Total
TILCON DELAWARE - HORSEPOND ROAD	Kent	0.04	0.00	0.00	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	New Castle	0.00	0.00	0.00	0.00
CONECTIV DELMARVA GENERATION-MADISON ST	New Castle	0.23	0.00	0.00	0.00
GENERAL CHEMICAL CORPORATION	New Castle	0.38	0.00	0.00	0.00
HARDCORE COMPOSITES, DIV. OF HARRIS SPEC	New Castle	0.00	0.00	0.00	0.00
KANEKA DELAWARE CORPORATION	New Castle	0.01	0.00	0.05	0.00
LAFARGE NORTH AMERICA INC	New Castle	0.32	0.00	0.05	0.00
LAIDLAW CORPORATION	New Castle	0.00	0.00	0.14	0.00
METACHEM PRODUCTS LLC	New Castle	0.00	0.00	0.00	0.00
OCCIDENTAL CHEMICAL CORPORATION	New Castle	0.25	0.00	0.01	0.00
VPI FILM LLC	New Castle	0.01	0.00	0.06	0.00
WESTVACO CORPORATION	New Castle	0.00	0.00	0.03	0.00
WILMINGTON PIECE DYE CO	New Castle	0.01	0.00	0.10	0.00
CITY OF LEWES POWER PLANT	Sussex	0.21	0.00	0.01	0.00

Total =	**1.46**	**0.00**	**0.44**	**0.00**

Among the above shutdown facilities, some have applied for and obtained emission reduction credits (ERCs) pursuant to Regulation No. 34, Emission Banking and Trading Program. In addition, where ERCs are certified from a shutdown source Reg. 34 provides for the Delaware Economic Development Office (DEDO) to receive 50% of the credits to use for initiatives to replace lost jobs that occurred due to the shutdown facility (Regulation No. 34, Reference 5-1). Table 5-2 is a list of the facilities/agency that hold ERCs.

Table 5-2. Emission Reduction Credits and Holding Facilities/Agency

ERC Holding Facility/Agency	VOC (Tons)		NO_X (Tons)	
	Ozone Season	Non-Ozone Season	Ozone Season	Non-Ozone Season
Delaware City Industries	4	2	1	1
DuPont	0	0	7	5
Lafarge	3	2	23	14
Delaware Economic Development Office (DEDO)	27	19	42	29
VPI Film LLC	6	4	1	1
Total	**40**	**27**	**74**	**50**

Using 7-month (or 214 days) for the ozone season from April to October as defined in Regulation No. 34 (Reference 5-1), the credits in Table 5-2 can be converted to ozone-season-daily emissions, as shown below:

Total VOC ERCs (TPD) = 40/214 = 0.19 TPD
Total NOx ERCs (TPD) = 74/214 = 0.35 TPD

In addition, the NOx emission rate shall be reduced to 20 ppm for the Cracker Carbon Monoxide Boiler at Premcor Refinery (formerly Motiva Enterprises) in Delaware City under a Consent Agreement (Reference 5-2). This consent agreement indicates that 250 TPY of the resultant NOx reductions will remain available for Premcor Refinery to use as emissions offsets. This results in 250/365 = 0.68 TPD NOx emission credit for Premcor Refinery.

Thus, the total emission reductions from facility/unit shutdown or modification that are available for the SIP planning are:

VOC emission reduction = 0.44 – 0.19 = 0.25 TPD
NOx emission reduction = 1.46 – 0.35-0.68 = 0.43 TPD

The above calculation treats the banked or authorized ERCs as “emitted emissions” in the context of this SIP revision. As such, the future use of these credits is consistent with, and will not interfere with any calculation or provision of this SIP document.

B. All other point sources.

Since there will be no new VOC controls for these point sources between 2008 and 2009, their 2008 emission reductions and projections are estimated by interpolating the 2002 base year emissions and the 2009 projections, as shown below.

2009 All-point source emission projection = 10.65 TPD
2009 Shutdown facility emissions (ERCs) = 0.19 TPD
2009 All other-point source emission
less shutdown facilities' emission = 10.65 – 0.19 = 10.46 TPD

2002 All point source emission = 9.91 TPD
2002 All other-point source emission
less shutdown facilities' emission = 9.91 – 0.44 = 9.47 TPD
2003-2008 Reduction from other point sources = (9.47 – 10.46) x 6/7 = -0.85 TPD
2008 All other-point source projection = 9.47 – (-0.85) = 10.32 TPD

C. All point sources

2003-2008 Reduction = 0.25 + (-0.85) = (-0.60) TPD
2008 All point source projection = 9.91– (-0.60) = 10.51 TPD

5.2 Non-Point Source VOC Control Measures and Reduction Estimates

Since there will be no new controls in the non-point source sector for VOC emissions between 2008 and 2009, the 2008 emission reductions and projections for the non-point sources are estimated by interpolating the 2002 base year emissions and the 2009 projections, as shown below.

5.2.1 Sussex County Area Source Controls and Emission Reductions

2009 Projection = 6.15 TPD
2002 Emission = 7.31 TPD
2003-2008 Reduction = (7.31 – 6.15) x 6/7 = 0.99 TPD
2008 Projection = 7.31 – 0.99 = 6.32 TPD

5.2.2 Kent and New Castle Counties Area Source Controls and Emission Reductions

2009 Projection = 20.95 TPD
2002 Emission = 25.77 TPD
2003-2008 Reduction = (25.77 – 20.95) x 6/7 = 4.13 TPD
2008 Projection = 25.77 – 4.13 = 21.64 TPD

5.3 Non-Road Mobile Sources VOC Control Measures and Reduction Estimates

Since there will be no new controls in the non-road mobile source sector for VOC emissions between 2008 and 2009, the 2008 emission reductions and projections for the non-road mobile sources are estimated by interpolating the 2002 base year emissions and the 2009 projections, as shown below.

5.3.1 Sussex County Non-Road Mobile Source Controls and Emission Reductions

2009 Projection	= 7.78 TPD
2002 Emission	= 9.36 TPD
2003-2008 Reduction	= (9.36 – 7.78) x 6/7 = 1.35 TPD
2008 Projection	= 9.36 – 1.35 = 8.01 TPD

5.3.2 Kent and New Castle Counties Non-Road Mobile Source Controls and Emission Reductions

2009 Projection	= 13.21 TPD
2002 Emission	= 17.41 TPD
2003-2008 Reduction	= (17.41 – 13.21) x 6/7 = 3.60 TPD
2008 Projection	= 17.41 – 3.60 = 13.81 TPD

5.4 On-Road Mobile Source VOC Control Measures and Reduction Estimates

The 2008 on-road mobile source VOC emissions were projected using EPA's MOBILE6.2 for obtaining emission factors and the "Peninsula Travel Demand Model (PTDM)" for predicting future vehicle miles traveled (VMT). The MOBILE6.2 runs were conducted by AQM's staff using the most recent available vehicle registration data and speed estimates (2005). The PTDM runs were conducted by staff of Delaware Department of Transportation (DelDOT). Details of the relevant model runs are presented in Section 9 and Appendix 9-1of this document.

5.4.1 Sussex County On-Road Mobile Source Emission Projections and Reductions

2002 Emission	= 9.95 TPD
2008 MOBILE6.2 Projection	= 7.09 TPD
2003-2008 Reduction	= 9.95 – 7.09 = 2.86 TPD

5.4.2 Kent and New Castle Counties On-Road Mobile Source Emission Projections and Reductions

2002 Emission	= 22.43 TPD
2008 MOBILE6.2 Projection	= 14.75 TPD
2003-2008 Reduction	= 22.43 – 14.75 = 7.68 TPD

5.4.3 Delaware 2008 On-Road Mobile Source NOx Emission Projections and Reductions

The 2008 on-road mobile source NOx emissions were projected using the same methods as for the VOC projections. The results are summarized below:

<u>Sussex County</u>

2002 NOx Emission	= 18.59 TPD
2008 MOBILE6.2 Projection	= 12.86 TPD
2003-2008 Reduction	= 18.95 – 12.86 = 6.09 TPD

<u>Kent and New Castle Counties</u>

2002 NOx Emission	= 50.53 TPD

2008 MOBILE6.2 Projection	= 31.03 TPD
2003-2008 Reduction	= 50.53 – 31.03 = 19.50 TPD

The above NOx reduction estimates for 2008 will serve for the 2008 contingency purpose, as discussed in Subsection 10.1 of this SIP revision.

5.5 Total VOC Emission Reductions for 2003-2008 RFP Requirements

5.5.1 Sussex County Total 2008 VOC Emission Projection

Point Source Sector	=	10.71 TPD
Area Source Sector	=	6.32 TPD
Non-Road Mobile Sector	=	8.01 TPD
On-Road Mobile Sector	=	7.09 TPD
Total 2008 Emission Projection		32.13 TPD

The total VOC emission projection meets the 2008 emission target under the 15% RFP requirements (33.00 TPD). Therefore, the 2008 RFP in Sussex County is demonstrated.

5.5.2 Kent and New Castle Counties Total VOC Emission Reductions

Point Source Sector	=	10.51 TPD
Area Source Sector	=	21.64 TPD
Non-Road Mobile Sector	=	13.81 TPD
On-Road Mobile Sector	=	14.75 TPD
Total 2008 Emission Projection		60.71 TPD

The total VOC emission projection meets the 2008 emission target under the 15% RFP requirements (61.66 TPD). Therefore, the 2008 RFP in Kent and New Castle Counties is demonstrated.

References

5-1. *Regulations Governing the Control of Air Pollution No. 34 Emission Banking and Trading Program*, Air Quality Management Section, Division of Air and Waste Management, Delaware Department of Natural Resources and Environmental Control, Dover, Delaware, October 1997.

5-2. *Consent Decree*, United States District Court for the Southern District of Texas, Delaware/Louisiana v. Motiva Enterprises, LLC, March 2001, and *Addendums to the Consent Decree*, December 2003 and June 2004

6. Control Measures and Emission Projections for Attainment

In Section 5 of this document, Delaware demonstrates that post-2002 emission controls will satisfy 2003-2008 RFP requirements. However, reductions in VOC emissions alone do not result in attainment of the ground level ozone NAAQS. Emissions of another major precursor, i.e., NOx, must also be reduced. For this reason, Delaware has implemented controls over a variety of NOx emission sources prior to the ozone season of 2009 to ensure attainment.

The 2009 emission projections for non-EGU point sources, non-point sources (formerly termed as "area sources"), and non-road mobile sources have been conducted by MACTEC Federal Programs, Inc. (hereafter referred to as MACTEC). The 2009 emission projections are explained in MACTEC's technical supporting document (Appendix 6-1). Delaware is basing its 2009 emission projection on this work conducted by MACTEC. However, the 2009 projections made by MACTEC have been updated in some cases for the following reasons:

(1) Delaware 2002 base year emission updates;
(2) Delaware specific growth factors;
(3) Control factor (CE, RE, etc) updates;
(4) Additional controls.

When any of the above reasons becomes valid, Delaware amended the 2009 projection(s) for the involved sources or source category, calculated its specific projections, and provides immediate or documentary explanations at appropriate locations in this document.

Delaware projected 2009 EGU emission as follows. The MANE-VU 2002 point source inventory contains a cross-reference table that matches IPM emission unit identifiers (ORISPL plant code and BLRID emission unit code) to MANE-VU NIF emission unit identifiers (FIPSST state code, FIPSCNTY county code, State Plant ID, State Point ID). Initially, MACTEC used this cross-reference table to split the point source file into the EGU and non-EGU components. When there was a match between the IPM ORISPL/BLRID and the MANE-VU emission unit ID, the unit was assigned to the EGU inventory; all other emission units were assigned to the non-EGU inventory.

After performing this initial splitting of the MANE-VU point source inventory into EGU and non-EGU components, MACTEC prepared several ad-hoc QA-QC queries to verify that there was no double-counting of emissions in the EGU and non-EGU inventories:

- The IPM parsed files to identify EGUs accounted for in IPM. This list of emission units to the non-EGU inventory derived from the MANE-VU cross-reference table was verified so that units accounted for in IPM were not double-counted in the non-EGU inventory.
- The non-EGU inventory was reviewed to identify remaining emission units with an Standard Industrial Classification (SIC) code of "4911 Electrical Services" or Source Classification Code of "1-01-xxx-xx External Combustion Boiler, Electric Generation". The list of sources meeting these selection criteria was then

compared to the IPM parsed file to ensure that these units were not double-counted.

- The number of records for each NIF table in the original 2002 point source file was verified to equal the 2002 EGU and 2002 non-EGU files. We determined that the sum of the number of records in the EGU file and the number of records in the non-EGU file equaled the number of records in the original 2002 point source file.
- We compared the emissions by pollutant in the original 2002 point source file to the 2002 EGU file and 2002 non-EGU files. We determined that the sum of the emissions in the EGU file and the emissions in the non-EGU file equaled the emissions in the original 2002 point source file.

As a result of this procedure, MACTEC created separate sets of NIF tables for 2002 for EGUs (i.e., units accounted for in IPM) and non-EGUs. The non-EGU set of 2002 NIF tables were used in all subsequent projections for 2009/2012/2018.

After reviewing the IPM results, AQMS found that the projections were unrealistic. For instance, IPM predicted all oil-burning EGUs would have no emissions in 2009. We know from regular interaction with these facilities that those units will be operating for the foreseeable future. Therefore, we discarded the IPM method and re-projected EGU emissions using Department of Energy growth factors. Afterwards, Delaware-specific controls from post-2002 regulations were applied. The source of data for determining growth was: Energy Information Administration (EIA), Annual Energy Review 2004 (mid-Atlantic), DOE/EIA-0384 (2004) (Washington, DC, August 2005). Using 2002 as the baseline, 2009 growth factors were derived by taking 2009 projected energy consumption by sector and source (quadrillion Btu), and then dividing that by 2003 growth rates. Controls were applied on a unit by unit basis, via the regulations listed in Table 6.1.

Finally, the 2009 mobile source emission projections were conducted by AQMS staff. The methods are discussed in Section 6.4 and Section 9 of this document.

6.1 Point Source Controls and 2009 Emission Projections

The following is a list of controls that Delaware has adopted or proposed to adopt prior to the 2009 ozone season, and therefore will lead to VOC and/or NOx emission reduction prior to the 2009 ozone season:

(1). Reg. 24. Sec. 46, Crude Oil Lightering Operations, VOC emission control, Sussex County, Effective May 2007;
(2). Reg. 1144, Control of Stationary Generator Emissions, VOC and NOx emission control, State-wide, Effective January 2006;
(3). Reg. 1146, EGUs, Electric Generating Unit (EGU) Multi-Pollutant Regulation, NOx emission control, State-wide, Effective 12/11/07;
(4). Regulation No. 1148, Control of Stationary Combustion Turbine Electric Generating Unit Emissions, NOx emission control, State-wide, Proposed rule.
(5) Regulation 1142, Section 1, Control of NOx Emissions From Industrial Boilers, NOX emission control, Effective December 2001.
(6). Regulation 1142, Section 2, Control of NOx Emissions From Industrial Boilers and Process Heaters at Petroleum Refineries, NOx emission control, New Castle County, to be effective July 2007.

(7) Consent Decree with Premcor Refinery at Delaware City (formerly Motiva Enterprises), New Castle County, Control of NOx Emission from Boilers and Heaters, Effective 2008.
(8) Control of NOx Emissions from Large Industrial Boilers and Process Heaters at Non-Refinery Facilities, NOx emission control, State-wide, under development and to be adopted in May 2008 with compliance date of May 1, 2009.

In addition to the above controls and rules, a number of point source facilities or units in those facilities have been shutdown after 2002, as indicated in Table 5-1 in Section 5. Also, the Cracker Carbon Monoxide Boiler at Premcor Refinery in Delaware City will be modified to a NOx emission rate limit of 20 ppm. The shutdowns and modification will lead to 0.25 TPD VOC reductions and 0.43 TPD NOx reductions, as indicated in Subsection 5.1 of this document.

The following tables are summaries of Delaware 2009 EGU and non-EGU emission projections:

- Table 6-1 is a summery of Delaware 2009 projection of emissions from electric generating units (EGUs), projected by AQMS staff using the procedure detailed in the above introduction to Section 6 of this document, and Regulations 1144, 1146, and 1148 as controls (Reference 6-1).

- Table 6-2 is a summary of Delaware 2009 VOC emissions from non-EGU point sources, where MACTEC's projections are revised by AQMS staff. Reasons for such revisions are provided in the footnotes of Table 6-2. Projections that are not changed are provided in Appendix 6-2, documented in MACTECs final report (Appendix 6-1).

- Table 6-3 is a summary of Delaware 2009 NOx emissions from non-EGU point sources, where MACTEC's projections are revised by AQMS staff. Reasons for such revisions are provided in the footnotes of Table 6-3. Projections that are not changed are provided in Appendix 6-2, documented in MACTECs final report (Appendix 6-1).

- Table 6-4 is a summary of Delaware 2009 VOC and NOx emissions from non-EGU point sources, where MACTEC's projections are not revised. Details of emission projections are provided in Appendix 6-1 and Appendix 6-2.

- Table 6-5 is a summary of Delaware 2009 VOC and NOx Emissions from All Point Sources.

Table 6-1. Delaware 2009 VOC and NOx Emission Projections (TPD) for Electric Generating Units (EGUs)

Facility Name	Unit Description	Post 2002 Regulation	NOX	VOC
CITY OF DOVER - MCKEE RUN GENERATING STA	BOILER #1	None*	0.427	0.006
CITY OF DOVER - MCKEE RUN GENERATING STA	BOILER #2	None	0.364	0.006
CITY OF DOVER - MCKEE RUN GENERATING STA	BOILER #3	Regulation No. 1146 (Effective 12/11/07)	0.896	0.022
CITY OF DOVER VAN SANT GENERATING STA	UNIT #11 GAS TURBINE	None	0.081	0.001
NRG ENERGY CENTER DOVER LLC	COGENERATION BOILER	None	1.607	0.000
NRG ENERGY CENTER DOVER LLC	TURBINE #1	None	0.147	0.000
NRG ENERGY CENTER DOVER LLC	TURBINE #2	None	0.112	0.000
WARREN F BEASLEY POWER STATION	COMBUSTION TURBINE	None	0.050	0.002
CONECTIV DELMARVA GENERATION-DEL CITY	TURBINE #10	Regulation No. 1148 (Proposed)	0.092	0.000
CONECTIV DELMARVA GENERATION-WEST_SUBST	TURBINE	Regulation No. 1148 (Proposed)	0.066	0.000
CONECTIV DELMARVA GENERATION-EDGE MOOR	GAS TURBINE	Regulation No. 1148 (Proposed)	0.091	0.000
CONECTIV DELMARVA GENERATION-EDGE MOOR	BOILER #3	Regulation No. 1146 (Effective 12/11/07)	1.633	0.029
CONECTIV DELMARVA GENERATION-EDGE MOOR	BOILER # 4	Regulation No. 1146 (Effective 12/11/07)	2.731	0.040
CONECTIV DELMARVA GENERATION-EDGE MOOR	BOILER # 5	Regulation No. 1146 (Effective 12/11/07)	6.529	0.188
MOTIVA ENTERPRISES LLC - DELAWARE CITY	BOILER 4	Regulation No. 1142, Section 2.0 (Proposed)	0.862	0.009
MOTIVA ENTERPRISES LLC - DELAWARE CITY	BOILER 1	Regulation No. 1142, Section 2.0 (Proposed)	0.171	0.000
MOTIVA ENTERPRISES LLC - DELAWARE CITY	BOILER 2	Regulation No. 1142, Section 2.0 (Proposed)	0.133	0.010
MOTIVA ENTERPRISES LLC - DELAWARE CITY	BOILER 3	Regulation No. 1142, Section 2.0 (Proposed)	0.819	0.000
MOTIVA ENTERPRISES LLC - DELAWARE CITY	REPOWERING CT1	None	0.618	0.042
MOTIVA ENTERPRISES LLC - DELAWARE CITY	REPOWERING CT2	None	0.224	0.011
CONECTIV DELMARVA GENERATION-CHRISTIANA	TURBINE #11	Regulation No. 1148 (proposed)	0.150	0.000
CONECTIV DELMARVA GENERATION-CHRISTIANA	TURBINE #14	Regulation No. 1148 (proposed)	0.155	0.000
CONECTIV DELMARVA GENERATION-HAY ROAD	COMBUSTION TURBINE #1	None	0.594	0.019
CONECTIV DELMARVA GENERATION-HAY ROAD	COMBUSTION TURBINE #2	None	0.858	0.020

CONECTIV DELMARVA GENERATION-HAY ROAD	COMBUSTION TURBINE #3	None	1.289	0.020
CONECTIV DELMARVA GENERATION-HAY ROAD	COMBUSTION TURBINE #5	None	0.246	0.001
CONECTIV DELMARVA GENERATION-HAY ROAD	COMBUSTION TURBINE #6	None	0.502	0.001
CONECTIV DELMARVA GENERATION-HAY ROAD	COMBUSTION TURBINE #7	None	0.356	0.001
INDIAN RIVER GENERATING STATION	BOILER #1	Regulation No. 1146 (Effective 12/11/07)	1.038	0.020
INDIAN RIVER GENERATING STATION	BOILER # 2	Regulation No. 1146 (Effective 12/11/07)	1.183	0.021
INDIAN RIVER GENERATING STATION	BOILER # 3	Regulation No. 1146 (Effective 12/11/07)	1.966	0.038
INDIAN RIVER GENERATING STATION	BOILER # 4	Regulation No. 1146 (Effective 12/11/07)	4.860	0.079
INDIAN RIVER GENERATING STATION	TURBINE #10	None	0.096	0.000
INVISTA	BOILER #1	None	1.741	0.005
INVISTA	BOILER #2	None	2.358	0.005
INVISTA	BOILER #3	None	2.226	0.005
CITY OF LEWES POWER PLANT	CATERPILLER ELEC PK #1	Regulation No. 1144 (Effective 1/11/06)	0.000	0.000
CITY OF LEWES POWER PLANT	CATERPILLER ELEC PK #2	Regulation No. 1144 (Effective 1/11/06)	0.000	0.000
CITY OF SEAFORD-ELECTRIC POWER PLANT	GENERATOR #1	Regulation No. 1144 (Effective 1/11/06)	0.000	0.000
CITY OF SEAFORD-ELECTRIC POWER PLANT	GENERATOR #2	Regulation No. 1144 (Effective 1/11/06)	0.000	0.000
CITY OF SEAFORD-ELECTRIC POWER PLANT	GENERATOR #3	Regulation No. 1144 (Effective 1/11/06)	0.000	0.000
CITY OF SEAFORD-ELECTRIC POWER PLANT	GENERATOR #4	Regulation No. 1144 (Effective 1/11/06)	0.000	0.000
CITY OF SEAFORD-ELECTRIC POWER PLANT	GENERATOR #6	Regulation No. 1144 (Effective 1/11/06)	0.000	0.000
		Total	**37.27**	**0.61**

* Indicating that the unit was not affected by post-2002 control or rule when calculating 2009 projection.

Table 6-2. Delaware 2009 VOC Emission Projections (TPD) for Non-EGU Point Sources Revised from MACTEC's Projections

County	Facility Name	Unit Description	Reason (See Notes)	VOC TPD
Kent	DOVER AIR FORCE BASE	BOILER #1/CENT HTNG PLANT	I	0.00
	PROCTOR AND GAMBLE DOVER WIPES COMPANY	BOILER #1	VIII	0.00
	TILCON DELAWARE - HORSEPOND ROAD	ASPHALT HOT MIX PLANT	III	0.00
	BAYHEALTH MED CENTER KENT GENERAL HOSP	1275 KW EMERENCY GENER	VI	0.00
	DE SOLID WASTE AUTHORITY SANDTOWN	LANDFILL	I	0.02
New Castle	DUPONT EXPERIMENTAL STATION	ELECTRICAL GENERATOR	VI	0.01
	DUPONT EXPERIMENTAL STATION	3 CATALYTIC CONVERTERS	IX	0.00
	GENERAL MOTORS CORPORATION	BOILER #1	X	0.00
	GENERAL MOTORS CORPORATION	BOILER #5	X	0.00
	GENERAL MOTORS CORPORATION	ELPO BATH	V	0.04
	GENERAL MOTORS CORPORATION	ELPO PRIM. OVENS & HTRS	X	0.02
	GENERAL MOTORS CORPORATION	PRIMER SURFACER BOOTH	X	0.00
	GENERAL MOTORS CORPORATION	PRIMER SURFACER BOOTH	V	0.17
	GENERAL MOTORS CORPORATION	PRIMER SURFACER OVEN	X	0.01
	GENERAL MOTORS CORPORATION	MOD SHOP BOOTHS	X	1.98
	GENERAL MOTORS CORPORATION	MOD SHOP BOOTHS	V	0.00
	GENERAL MOTORS CORPORATION	MOD SHOP OVENS	X	0.04
	GENERAL MOTORS CORPORATION	DEADNER BOOTH	X	0.00
	GENERAL MOTORS CORPORATION	FINAL REPAIR AREA	X	0.00
	GENERAL MOTORS CORPORATION	FINAL REPAIR AREA	V	0.03
	GENERAL MOTORS CORPORATION	MISC. SOURCES	X	0.00
	GENERAL MOTORS CORPORATION	MISC. SOURCES	V	1.19
	GENERAL MOTORS CORPORATION	40,000 GAL GASOLINE TANK	X	0.02
	GENERAL MOTORS CORPORATION	ELPO/TOPCOAT RTO	X	0.00
	GENERAL MOTORS CORPORATION	PRIMER/SRUFACER RTO	X	0.00
	GENERAL MOTORS CORPORATION	SEALER CURE OVEN	X	0.03
	GENERAL MOTORS CORPORATION	BODY WASHER OVEN #1	X	0.00
	GENERAL MOTORS CORPORATION	BODY WASHER OVEN #2	X	0.00
	SUNCO INC R M	BOILER #2	I	0.00
	CHRISTIANA CARE - WILMINGTON HOSPITAL	PEAKING UNIT #1	IX	0.00

FORMOSA PLASTICS CORPORATION	INCINERATORS WB710/711	I	0.04
LAIDLAW CORPORATION	CAPING MACHINE # 1	III	0.00
LAIDLAW CORPORATION	LATEX APPPLN ON TUBES	III	0.00
LAIDLAW CORPORATION	TUBE LAMINATING	III	0.00
LAIDLAW CORPORATION	3 LANE HANGER LINE	III	0.00
LAIDLAW CORPORATION	STRAIGHT & CUT (S&C) # 1	III	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	BOILER 2	III	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	RESIN MANUFACTURING	III	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	HAVEG 41/61 TANK MANUFACT	III	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	PHENOL TANK	III	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	SILTEMP - WEB COATER	III	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	DEGREASER	III	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	SILTEMP - HCL FILL TANKS	III	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	SILTEMP - ACID DIGESTERS	III	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	HCL MIX TANK/NEUT. TANK	III	0.00
AMETEK INC CHEMICAL PRODUCTS DIVISION	OBNOXIOUS FUME SCRUBBER	III	0.00
OCCIDENTAL CHEMICAL CORPORATION	BOILER #2	VIII	0.00
OCCIDENTAL CHEMICAL CORPORATION	BOILER #5	VIII	0.00
OCCIDENTAL CHEMICAL CORPORATION	CHLORINE LIQUIFICATION	VIII	0.00
ROHM & HAAS ELECTRONIC MATERIALS CMP TE	B2 EMERGENCY GENERATOR	VI	0.00
ROHM & HAAS ELECTRONIC MATERIALS CMP TE	B5 EMERGENCY GENERATOR	VI	0.00
FP INTERNATIONAL INC	EXTRUDER LINE #1	I	0.10
FP INTERNATIONAL INC	EXTRUDER RECYCLE LINE #3	I	0.00
VETERANS ADMINISTRATION HOSPSITAL	BOILER #1	I	0.00
VETERANS ADMINISTRATION HOSPSITAL	5 DIESEL GENERATORS	VI	0.00
CHRISTIANA CARE - CHRISTIANA HOSPITAL	PEAKING UNIT #1	II	0.23
DE SOLID WASTE AUTHORITY PIGEON POINT	LANDFILL	I	0.01
DE SOLID WASTE AUTHORITY CHERRY ISLAND	FUGITIVE VOCS - LANDFILL	I	0.04
WESTVACO CORPORATION	WEB OFF-SET PRINTING	III	0.00
WESTVACO CORPORATION	PARTS WASHERS	III	0.00
DAIMLERCHRYSLER CORPORATION	ECOAT PRIMER BOOTH	XI	0.03
DAIMLERCHRYSLER CORPORATION	MISC. PRODUCTIVE ITEMS	XI	0.22

	DAIMLERCHRYSLER CORPORATION	POWER ANTI CHIP BOOTH	XI	0.00
	DAIMLERCHRYSLER CORPORATION	COLOR 1&2 TOP COAT BOOTHS	XI	0.86
	DAIMLERCHRYSLER CORPORATION	LO BAKE REPAIR BOOTH	XI	0.03
	DAIMLERCHRYSLER CORPORATION	TOUCH UP AREA	XI	0.00
	DAIMLERCHRYSLER CORPORATION	NON-PRODUCTIVE	XI	0.56
	DAIMLERCHRYSLER CORPORATION	PH EMERG DIESEL GEN 1	VI	0.00
	DAIMLERCHRYSLER CORPORATION	PH EMERG. DIESEL GEN 2	VI	0.00
	DUPONT STINE - HASKELL LABORATORY	EMERGENCY DIESEL GEN. #1	VI	0.00
	DUPONT STINE - HASKELL LABORATORY	EMERGENCY DIESEL GEN. #2	VI	0.00
	SPATZ FIBERGLASS PRODUCTS	MANUFACTURING OF PLASTIC	I	0.00
	DELAWARE RECYCLABLE PRODUCTS INC	LANDFILL WASTE GAS	I	0.01
	PURE GREEN INDUSTRIES INC	DIESEL GENERATOR	VI	0.00
	GE ENERGY (USA) LLC	SINGLE CRYSTAL LINE	I	0.01
	HARDCORE COMPOSITES, DIV. OF HARRIS SPEC	DATAS	III	0.00
Sussex	ORIENT CORPORATION OF AMERICA	FACILITY FUGITIVES	I	0.01
	BAYHEALTH MEDICAL CTR - MILFORD MEMORIAL	600 KW EMERCENCY GEN	VI	0.00
	PERDUE FARMS INC - GEORGETOWN	EMERGENCY GENERATOR	VI	0.00
	MARITRANS	LIGHTERING OPERATION	IV	7.26
	EDWARD J. KAYE CONSTRUCTION	CRUSHER DIESEL ENGINE	I	0.00
Total State Projection				**12.98**

Notes:

I. Delaware’s 2002 emissions for this individual record were different than the MACTEC 2002 emissions. To obtain a Delaware-specific projected 2009 emission, Delaware’s actual 2002 emissions for this individual record were grown and controlled using the same methodology as MACTEC in its 2009 projection for this record.

II. These units will be retrofitted by 2009 to be bi-fuel operated on natural gas and diesel fuel. Thus, Delaware has projected these unit’s 2009 emissions using the same growth factor as used by MACTEC, and controls based upon the emission standards required by Reg. 1144.

III. This facility was shutdown after 2002, and its emissions were zeroed out, since the MACTEC 2009 projection inventory did not include this facility as being shutdown.

IV. Delaware reevaluated the VOC emission reductions due to adopting a regulation to control lightering, and estimated that a control efficiency of 39% would be more accurate. Thus, Delaware has projected the 2009 VOC emissions from lightering using the same growth factor as used by MACTEC and this new control efficiency.

V. The MACTEC 2009 projected emissions for this unit include a reduction due to MACT controls. Delaware does not believe that MACT controls are installed on this unit. Additionally, the facility operated well below its capacity in 2002. Thus, Delaware has projected this unit’s 2009 emissions using a growth factor estimated by Delaware, and without assuming any MACT controls.

VI. Due to the requirements of Regulation No. 1144, Delaware assumes no growth or control of the emissions of this unit, and assumes its projected 2009 emissions to be equal to its 2002 emissions.

VIII. This unit was shutdown after 2002, and its emissions were zeroed out, since the MACTEC 2009 projection inventory did not include this unit as being shutdown.

IX. This unit was classified as a "distributed generator," and was subject to emission controls, under Regulation No. 1144. However, the facility chose to reclassify the unit as an "emergency generator" instead of installing controls. Thus, Delaware has zeroed out its projected 2009 emissions since its expected operation as an emergency generator shall yield few, if any, ozone season emissions.

X. The facility operated well below its capacity in 2002. Thus, Delaware has projected this unit's 2009 emissions using a growth factor estimated by Delaware.

XI. The MACTEC 2009 projected emissions for this unit include a reduction due to MACT controls. Delaware does not believe that MACT controls are installed on this unit. Thus, Delaware has projected this unit's 2009 emissions using the same growth factor as used by MACTEC, but without assuming any MACT controls.

Table 6-3. Delaware 2009 NOx Emission Projections (TPD) for Non-EGU Point Sources Revised from MACTECs Projections

County	Facility Name	Unit Desc.	Reason (See Notes)	NOx TPD
Kent	DOVER AIR FORCE BASE	BOILER #1/CENT HTNG PLANT	I	0.00
	PROCTOR AND GAMBLE DOVER WIPES COMPANY	BOILER #1	VIII	0.00
	TILCON DELAWARE - HORSEPOND ROAD	ASPHALT HOT MIX PLANT	III	0.00
	BAYHEALTH MED CENTER KENT GENERAL HOSP	1275 KW EMERENCY GENER	VI	0.01
New Castle	DUPONT EXPERIMENTAL STATION	ELECTRICAL GENERATOR	VI	0.11
	DUPONT EXPERIMENTAL STATION	3 CATALYTIC CONVERTERS	IX	0.00
	GENERAL MOTORS CORPORATION	BOILER #1	X	0.05
	GENERAL MOTORS CORPORATION	BOILER #5	X	0.03
	GENERAL MOTORS CORPORATION	ELPO PRIM. OVENS & HTRS	X	0.02
	GENERAL MOTORS CORPORATION	PRIMER SURFACER BOOTH	X	0.01
	GENERAL MOTORS CORPORATION	PRIMER SURFACER OVEN	X	0.00
	GENERAL MOTORS CORPORATION	MOD SHOP BOOTHS	X	0.03
	GENERAL MOTORS CORPORATION	MOD SHOP OVENS	X	0.01
	GENERAL MOTORS CORPORATION	DEADNER BOOTH	X	0.01
	GENERAL MOTORS CORPORATION	FINAL REPAIR AREA	X	0.02
	GENERAL MOTORS CORPORATION	MISC. SOURCES	X	0.01
	GENERAL MOTORS CORPORATION	ELPO/TOPCOAT RTO	X	0.03
	GENERAL MOTORS CORPORATION	PRIMER/SRUFACER RTO	X	0.02
	GENERAL MOTORS CORPORATION	SEALER CURE OVEN	X	0.00
	GENERAL MOTORS CORPORATION	BODY WASHER OVEN #1	X	0.00
	GENERAL MOTORS CORPORATION	BODY WASHER OVEN #2	X	0.00
	MOTIVA ENTERPRISES LLC - DELAWARE CITY	HEATER #2 FOR UNIT 21-H-2	VII	0.06
	MOTIVA ENTERPRISES LLC - DELAWARE CITY	REPOWER - CLEAN GAS FLARE	I	0.42
	CHRISTIANA CARE - WILMINGTON HOSPITAL	PEAKING UNIT #1	IX	0.00
	AMETEK INC CHEMICAL PRODUCTS DIVISION	BOILER 2	III	0.00
	OCCIDENTAL CHEMICAL CORPORATION	BOILER #2	VIII	0.00
	OCCIDENTAL CHEMICAL CORPORATION	BOILER #5	VIII	0.00
	GENERAL CHEMICAL CORPORATION	NITRITES PRODUCTION	I	0.00
	ROHM & HAAS ELECTRONIC MATERIALS CMP TE	B2 EMERGENCY GENERATOR	VI	0.00
	ROHM & HAAS ELECTRONIC MATERIALS CMP TE	B5 EMERGENCY GENERATOR	VI	0.06

	CONECTIV DELMARVA GENERATION-MADISON ST	GAS TURBINE	III	0.00
	VETERANS ADMINISTRATION HOSPSITAL	BOILER #1	I	0.00
	VETERANS ADMINISTRATION HOSPSITAL	5 DIESEL GENERATORS	VI	0.01
	CHRISTIANA CARE - CHRISTIANA HOSPITAL	PEAKING UNIT #1	II	0.43
	DE SOLID WASTE AUTHORITY PIGEON POINT	LANDFILL	I	0.00
	MACDERMID INC	COATING LINE	I	0.00
	DAIMLERCHRYSLER CORPORATION	PH EMERG DIESEL GEN 1	VI	0.01
	DAIMLERCHRYSLER CORPORATION	PH EMERG. DIESEL GEN 2	VI	0.01
	DUPONT STINE - HASKELL LABORATORY	EMERGENCY DIESEL GEN. #1	VI	0.05
	DUPONT STINE - HASKELL LABORATORY	EMERGENCY DIESEL GEN. #2	VI	0.06
	PURE GREEN INDUSTRIES INC	DIESEL GENERATOR	VI	0.04
Sussex	BAYHEALTH MEDICAL CTR - MILFORD MEMORIAL	600 KW EMERCENCY GEN	VI	0.03
	PERDUE FARMS INC - GEORGETOWN	EMERGENCY GENERATOR	VI	0.00
	EDWARD J. KAYE CONSTRUCTION	CRUSHER DIESEL ENGINE	I	0.02
Total State Projection				**1.60**

Notes:

I. Delaware's 2002 emissions for this individual record were different than the MACTEC 2002 emissions. To obtain a Delaware-specific projected 2009 emission, Delaware's actual 2002 emissions for this individual record were grown and controlled using the same methodology as MACTEC in its 2009 projection for this record.

II. These units will be retrofitted by 2009 to be bi-fuel operated on natural gas and diesel fuel. Thus, Delaware has projected these unit's 2009 emissions using the same growth factor as used by MACTEC, and controls based upon the emission standards required by Reg. 1144.

III. This facility was shutdown after 2002, and its emissions were zeroed out, since the MACTEC 2009 projection inventory did not include this facility as being shutdown.

VI. Due to the requirements of Regulation No. 1144, Delaware assumes no growth or control of the emissions of this unit, and assumes its projected 2009 emissions to be equal to its 2002 emissions.

VII. Delaware's proposed amendments to Regulation No. 1142, Section 2.0 will control the emissions from this unit once adopted. Thus, Delaware has projected this unit's 2009 emissions using the same growth factor as used by MACTEC, and an assumed 80% reduction in NOx from the unit's current permit limits.

VIII. This unit was shutdown after 2002, and its emissions were zeroed out, since the MACTEC 2009 projection inventory did not include this unit as being shutdown.

IX. This unit was classified as a "distributed generator," and was subject to emission controls, under Regulation No. 1144. However, the facility chose to reclassify the unit as an "emergency generator" instead of installing controls. Thus, Delaware has zeroed out its projected 2009 emissions since its expected operation as an emergency generator shall yield few, if any, ozone season emissions.

X. The facility operated well below its capacity in 2002. Thus, Delaware has projected this unit's 2009 emissions using a growth factor estimated by Delaware.

Table 6-4. Delaware 2009 VOC and NOx Emission Projections (TPD) for Non-EGU Point Sources Not Revised from MACTEC's Projections

		Non-EGU Emissions	
County	**FIPS**	**VOC**	**NOx**
Kent	10001	0.34	0.53
New Castle	10003	4.17	9.91
Sussex	10005	0.20	1.02
State-Total		4.70	11.46

Table 6-5. Delaware 2009 VOC and NOx Emission Projections (TPD) for All Point Sources

		EGU Emissions		Non-EGU Emissions		Total Emission	
County	**FIPS**	**VOC**	**NOx**	**VOC**	**NOx**	**VOC**	**NOx**
Kent	10001	0.04	3.68	0.36	0.55	0.39	4.23
New Castle	10003	0.39	18.12	9.86	11.44	10.25	29.57
Sussex	10005	0.17	15.47	7.47	1.08	7.64	16.54
State-Total		0.61	37.27	17.68	13.07	**18.28**	**50.34**

6.2 Non-Point Source Controls and 2009 Emission Projections

The following is a list of non-point source controls that Delaware has adopted or proposed to adopt prior to the 2009 ozone season, and therefore will lead to VOC and/or NOx emission reduction prior to the 2009 ozone season:

(1). Reg. 24 Sec. 33, Solvent Cleaning and Drying, VOC emission control, Statewide, Effective November, 2002.
(2). Reg. 24 Sec. 11, Mobile Equipment Repair and Refinishing, VOC emission control, State-wide, Effective October, 2003.
(3). Reg. 41 Sec. 3, Portable Fuel Containers, VOC emission control, State-wide, Effective January 2003.
(4). Reg. 41 Sec. 2, Consumer Products, VOC emission control, State-wide, Effective January 2005.
(5). Reg. 41 Sec 1, Architectural and Industrial Maintenance Coatings, VOC emission control, State-wide, Effective January 2005.
(6) Reg. 24 Sec. 36, Stage II Vapor Recovery, VOC Emission control, State-wide, Effective January 2002.
(7) Federal Residential Woodstove NSPS, VOC and NOx emission control.
(8) Reg. 1113, Open Burning, VOC and NOx emission control, State-wide, Revised and Effective April 2007.

The following tables are summaries of Delaware 2009 emission projections for non-point sources:

- Table 6-6 is a summary of Delaware 2009 VOC emissions from non-point sources, where MACTEC's projections are revised by AQM staff. Reasons for such revisions are provided in the footnotes of Table 6-6.

- Table 6-7 is a summary of Delaware 2009 NOx emissions from non-point sources, where MACTEC's projections are revised by AQMS staff. Reasons for such revisions are provided in the footnotes of Table 6-7.

- Table 6-8 is a summary of Delaware 2009 VOC and NOx emissions from non-point sources, where MACTEC's projections are not revised. Details of emission projections are provided in Appendix 6-1 and Appendix 6-2.

- Table 6-9 is a summary of Delaware 2009 VOC and NOx Emissions from All Point Sources.

Table 6-6. Delaware 2009 VOC Emission Projections (TPD) for Non-Point Sources Revised from MACTECs Projections

SCC	SCC_L1	SCC_L2	SCC_L3	SCC_L4	Reason (See Notes)	2009 VOC Emissions (TPD) Kent	New Castle	Sussex
2102002000	Stationary Source Fuel Combustion	Industrial	Bituminous/Subbituminous Coal	Total: All Boiler Types	I	0.00	0.00	0.00
2102004000	Stationary Source Fuel Combustion	Industrial	Distillate Oil	Total: Boilers and IC Engines	I	0.00	0.00	0.00
2102006000	Stationary Source Fuel Combustion	Industrial	Natural Gas	Total: Boilers and IC Engines	I	0.01	0.04	0.02
2102007000	Stationary Source Fuel Combustion	Industrial	Liquified Petroleum Gas (LPG)	Total: All Boiler Types	I	0.00	0.00	0.00
2103001000	Stationary Source Fuel Combustion	Commercial/Institutional	Anthracite Coal	Total: All Boiler Types	I	0.00	0.00	0.00
2103004000	Stationary Source Fuel Combustion	Commercial/Institutional	Distillate Oil	Total: Boilers and IC Engines	I	0.00	0.00	0.00
2103006000	Stationary Source Fuel Combustion	Commercial/Institutional	Natural Gas	Total: Boilers and IC Engines	I	0.00	0.02	0.00
2103007000	Stationary Source Fuel Combustion	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Total: All Combustor Types	I	0.00	0.00	0.00
2104002000	Stationary Source Fuel Combustion	Residential	Bituminous/Subbituminous Coal	Total: All Combustor Types	I	0.00	0.00	0.00
2104004000	Stationary Source Fuel Combustion	Residential	Distillate Oil	Total: All Combustor Types	I	0.00	0.01	0.00
2104006000	Stationary Source Fuel Combustion	Residential	Natural Gas	Total: All Combustor Types	I	0.00	0.02	0.00
2104007000	Stationary Source Fuel Combustion	Residential	Liquified Petroleum Gas (LPG)	Total: All Combustor Types	I	0.00	0.00	0.01
2104008000	Stationary Source Fuel Combustion	Residential	Wood	Total: Woodstoves and Fireplaces	IV	0.02	0.04	0.03
2104008070	Stationary Source Fuel Combustion	Residential	Wood	Outdoor Wood Burning Equipment	IV	0.02	0.05	0.03
2104011000	Stationary Source Fuel Combustion	Residential	Kerosene	Total: All Heater Types	I	0.00	0.00	0.00
2401005500	Solvent Utilization	Surface Coating	Auto Refinishing: SIC	Surface Preparation	IX	0.00	0.01	0.00

			7532	Solvents				
2401005600	Solvent Utilization	Surface Coating	Auto Refinishing: SIC 7532	Primers	IX	0.02	0.16	0.05
2401005700	Solvent Utilization	Surface Coating	Auto Refinishing: SIC 7532	Top Coats	IX	0.04	0.29	0.07
2401005800	Solvent Utilization	Surface Coating	Auto Refinishing: SIC 7532	Clean-up Solvents	IX	0.00	0.04	0.01
2401008000	Solvent Utilization	Surface Coating	Traffic Markings	Total: All Solvent Types	I	0.12	0.21	
2401045000	Solvent Utilization	Surface Coating	Metal Coils: SIC 3498	Total: All Solvent Types	I		0.03	
2401075000	Solvent Utilization	Surface Coating	Aircraft: SIC 372	Total: All Solvent Types	I		0.00	
2415100000	Solvent Utilization	Degreasing	All Industries: Open Top Degreasing	Total: All Solvent Types	I	0.01	0.09	0.02
2415130000	Solvent Utilization	Degreasing	Electronic and Other Elec. (SIC 36): Open Top Degreasing	Total: All Solvent Types	I	0.00	0.01	
2415300000	Solvent Utilization	Degreasing	All Industries: Cold Cleaning	Total: All Solvent Types	V	0.00	0.10	0.01
2415360000	Solvent Utilization	Degreasing	Auto Repair Services (SIC 75): Cold Cleaning	Total: All Solvent Types	V	0.33	1.06	0.36
2425010000	Solvent Utilization	Graphic Arts	Lithography	Total: All Solvent Types	I	0.08	1.09	0.04
2425020000	Solvent Utilization	Graphic Arts	Letterpress	Total: All Solvent Types	I	0.02	0.20	0.01
2440020000	Solvent Utilization	Miscellaneous Industrial	Adhesive (Industrial) Application	Total: All Solvent Types	III	0.51	1.57	0.27
2461021000	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Cutback Asphalt	Total: All Solvent Types	I			0.07
2461850001	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Corn	I	0.25		
2461850006	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Hay & Grains	I	0.00	0.00	0.00
2461850009	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Herbicides, Not Elsewhere Classified	II	0.06	0.03	0.11

2461850056	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Hay & Grains	I	0.01	0.01	0.01
2461850099	Solvent Utilization	Miscellaneous Non-industrial: Commercial	Pesticide Application: Agricultural	Other Pesticides, Not Elsewhere Classified	II	0.01	0.00	0.01
2501010050	Storage and Transport	Petroleum and Petroleum Product Storage	Marinas: Gasoline	Stage 1: Total	II		0.07	0.07
2501010102	Storage and Transport	Petroleum and Petroleum Product Storage	Marinas: Gasoline	Stage 2: Displacement Loss	I		0.01	0.01
2501010103	Storage and Transport	Petroleum and Petroleum Product Storage	Marinas: Gasoline	Stage 2: Spillage	I		0.00	0.00
2501010201	Storage and Transport	Petroleum and Petroleum Product Storage	Marinas: Gasoline	Underground Tank: Emptying and Breathing	I		0.01	0.01
2501011010	Storage and Transport	Petroleum and Petroleum Product Storage	Portable Containers: Residential	Vapor Losses	I	0.00	0.00	0.00
2501011011	Storage and Transport	Petroleum and Petroleum Product Storage	Portable Containers: Residential	Permeation	I	0.02	0.09	0.03
2501011012	Storage and Transport	Petroleum and Petroleum Product Storage	Portable Containers: Residential	Diurnal	I	0.20	0.78	0.28
2501011015	Storage and Transport	Petroleum and Petroleum Product Storage	Portable Containers: Residential	Spillage	I	0.00	0.00	0.00
2501011016	Storage and Transport	Petroleum and Petroleum Product Storage	Portable Containers: Residential	Transport	I	0.01	0.04	0.02
2501012010	Storage and Transport	Petroleum and Petroleum Product Storage	Portable Containers: Commercial	Vapor Losses	I	0.00	0.00	0.00
2501012011	Storage and Transport	Petroleum and Petroleum Product Storage	Portable Containers: Commercial	Permeation	I	0.00	0.00	0.00
2501012012	Storage and Transport	Petroleum and Petroleum Product Storage	Portable Containers: Commercial	Diurnal	I	0.01	0.04	0.02
2501012015	Storage and Transport	Petroleum and Petroleum Product Storage	Portable Containers: Commercial	Spillage	I	0.00	0.00	0.00
2501012016	Storage and Transport	Petroleum and Petroleum Product Storage	Portable Containers: Commercial	Transport	I	0.01	0.03	0.02
2501060051	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Submerged Filling	I	0.01	0.02	0.03
2501060053	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 1: Balanced Submerged Filling	I	0.15	0.42	0.19

2501060100	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Total	VIII	0.14	0.40	0.18
2501060201	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Underground Tank: Breathing and Emptying	I	0.03	0.10	0.05
2501060204	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Off-Highway Equipment Displacement Loss/Controlled	I	0.01	0.02	0.01
2501060205	Storage and Transport	Petroleum and Petroleum Product Storage	Gasoline Service Stations	Stage 2: Off-Highway Equipment Spillage	I	0.01	0.02	0.01
2501080050	Storage and Transport	Petroleum and Petroleum Product Storage	Airports : Aviation Gasoline	Stage 1: Total	I	0.01	0.05	0.01
2501080102	Storage and Transport	Petroleum and Petroleum Product Storage	Airports: Aviation Gasoline	Stage 2: Displacement Loss	I		0.06	
2501080201	Storage and Transport	Petroleum and Petroleum Product Storage	Airports: Aviation Gasoline	Underground Tank: Breathing and Emptying	I		0.03	
2501090050	Storage and Transport	Petroleum and Petroleum Product Storage	Airports: Jet A or JP-8	Stage 1: Total	I	0.00	0.00	
2501090101	Storage and Transport	Petroleum and Petroleum Product Storage	Airports: Jet A or JP-8	Stage 2: Total	I	0.00	0.00	
2505020030	Storage and Transport	Petroleum and Petroleum Product Transport	Marine Vessel	Crude Oil	I	0.21	0.34	0.37
2505020060	Storage and Transport	Petroleum and Petroleum Product Transport	Marine Vessel	Residual Oil	I	0.00	0.00	0.00
2505020090	Storage and Transport	Petroleum and Petroleum Product Transport	Marine Vessel	Distillate Oil	I	0.00	0.00	0.00
2505020120	Storage and Transport	Petroleum and Petroleum Product Transport	Marine Vessel	Gasoline	I	0.04	0.09	0.05
2505020150	Storage and Transport	Petroleum and Petroleum Product Transport	Marine Vessel	Jet Naphtha	I	0.00	0.01	0.00
2505030120	Storage and Transport	Petroleum and Petroleum Product Transport	Truck	Gasoline	I	0.01	0.03	0.01
2610000400	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Yard Waste - Brush Species Unspecified	VI			0.00

2610000500	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)	VII			0.06
2630020000	Waste Disposal, Treatment, and Recovery	Wastewater Treatment	Public Owned	Total Processed	I	0.00	0.00	0.00
2660000000	Waste Disposal, Treatment, and Recovery	Leaking Underground Storage Tanks	Leaking Underground Storage Tanks	Total: All Storage Types	II			0.00
2810001000	Miscellaneous Area Sources	Other Combustion	Forest Wildfires	Total	I	0.07	0.00	0.00
2810035000	Miscellaneous Area Sources	Other Combustion	Firefighting Training	Total	X	0.00	0.00	0.00
County Totals						**2.49**	**7.75**	**2.57**
Total State Projection					**12.81**			

Notes:

I. Delaware's 2002 emissions for this individual record were different than the MACTEC 2002 emissions. To obtain a Delaware-specific projected 2009 emission, Delaware's actual 2002 emissions for this individual record were grown and controlled using the same methodology as MACTEC in its 2009 projection for this record.

II. The MACTEC projected 2009 inventory did not include any emissions for this SCC. Thus, Delaware's 2002 tons per day emissions for this SCC were projected to 2009 using growth factors supplied by MACTEC.

III. The MACTEC projected 2009 inventory did not include ozone season tons per day emissions for the SCC of 2440020000. Thus, Delaware's 2002 tons per day emissions for this SCC were projected to 2009 using the same methodology as MACTEC applied to the annual emissions for this SCC.

IV. Since Delaware adjusted its 2002 emissions for residential wood combustion based on a new report by OMNI, 2009 emissions had to be re-projected. Thus, Delaware's corrected 2002 emissions were projected to 2009 to 2009 using growth factors supplied by MACTEC.

V. Delaware's 2002 inventory only reflects partial controls due to OTC 2001 VOC Model Rules for Solvent Cleaning Operations. Thus, Delaware has projected the 2009 emission for these SCCs by first recalculating the 2002 emissions as if 100% rule effectiveness were applied, and then applying the same growth factors used by MACTEC.

VI. Due to Delaware's amendments to its open burning regulation, it is expected that emissions due to yard waste burning will decrease. Thus, Delaware has projected the 2009 emission for the SCC of 2610000500 by first recalculating the 2002 emissions as if the same control efficiency, rule effectiveness, and rule penetration used for Kent and New Castle counties were applied, and then applying the same growth factors used by MACTEC.

VII. Due to Delaware's amendments to its open burning regulation, it is expected that emissions due to land clearing debris burning will decrease. Thus, Delaware has projected the 2009 emission for the SCC of 2610000500 by first recalculating the 2002 emissions as if 90% rule effectiveness were applied, and then applying the same growth factors used by MACTEC.

VIII. The MACTEC projected 2009 emissions from Stage II vapor recovery for SCC 2501060100 were based upon Delaware's 2002 emissions which did not include a 100% rule effectiveness for the controls. Delaware amended its requirements for Stage II vapor recovery in 2002, which resulted in 100% rule effectiveness for controls after 2002. Thus, Delaware calculated its emissions from Stage II vapor recovery in 2003 using 100% rule effectiveness, and then projected those emissions to 2009 using a six-year growth factor from 2003 to 2009, which was based upon MACTEC's growth factor from 2002 to 2009.

IX. Delaware's 2002 inventory already reflects controls for the OTC 2001 VOC Model Rules Mobile Equipment Repair and Refinishing. Thus, Delaware has projected the 2009 emissions for these SCCs using the same growth factor as used by MACTEC, but with no further controls.

X. Delaware recently amended its regulation pertaining to open burning, which extended the ozone season open burning prohibition out to May through September, and applies the prohibition to all counties in the state. Due to the regulation's amendment, there will be no approvals issued for firefighting training in any county; thus, Delaware has zeroed out those emissions.

Table 6-7. Delaware 2009 NOx Emission Projections (TPD) for Non-Point Sources Revised from MACTEC's Projections

SCC	SCC_L1	SCC_L2	SCC_L3	SCC_L4	Reason (See Notes)	2009 NOx Emissions (TPD) Kent	New Castle	Sussex
2102002000	Stationary Source Fuel Combustion	Industrial	Bituminous/Subbituminous Coal	Total: All Boiler Types	I	0.01	0.02	0.00
2102004000	Stationary Source Fuel Combustion	Industrial	Distillate Oil	Total: Boilers and IC Engines	I	0.00	0.03	0.01
2102006000	Stationary Source Fuel Combustion	Industrial	Natural Gas	Total: Boilers and IC Engines	I	0.13	0.99	0.40
2102007000	Stationary Source Fuel Combustion	Industrial	Liquified Petroleum Gas (LPG)	Total: All Boiler Types	I	0.00	0.00	0.00
2103001000	Stationary Source Fuel Combustion	Commercial/Institutional	Anthracite Coal	Total: All Boiler Types	I	0.00	0.00	0.00
2103004000	Stationary Source Fuel Combustion	Commercial/Institutional	Distillate Oil	Total: Boilers and IC Engines	I	0.02	0.06	0.03
2103006000	Stationary Source Fuel Combustion	Commercial/Institutional	Natural Gas	Total: Boilers and IC Engines	I	0.06	0.38	0.01
2103007000	Stationary Source Fuel Combustion	Commercial/Institutional	Liquified Petroleum Gas (LPG)	Total: All Combustor Types	I	0.01	0.01	0.03
2104002000	Stationary Source Fuel Combustion	Residential	Bituminous/Subbituminous Coal	Total: All Combustor Types	I	0.00	0.00	0.00
2104004000	Stationary Source Fuel Combustion	Residential	Distillate Oil	Total: All Combustor Types	I	0.04	0.14	0.06
2104006000	Stationary Source Fuel Combustion	Residential	Natural Gas	Total: All Combustor Types	I	0.05	0.37	0.01
2104007000	Stationary Source Fuel Combustion	Residential	Liquified Petroleum Gas (LPG)	Total: All Combustor Types	I	0.08	0.07	0.17
2104008000	Stationary Source Fuel Combustion	Residential	Wood	Total: Woodstoves and Fireplaces	IV	0.00	0.00	0.00
2104008070	Stationary Source Fuel Combustion	Residential	Wood	Outdoor Wood Burning Equipment	IV	0.00	0.01	0.00
2104011000	Stationary Source Fuel Combustion	Residential	Kerosene	Total: All Heater Types	I	0.00	0.00	0.00
2610000400	Waste Disposal,	Open Burning	All Categories	Yard Waste - Brush	VI			0.00

	Treatment, and Recovery			Species Unspecified				
2610000500	Waste Disposal, Treatment, and Recovery	Open Burning	All Categories	Land Clearing Debris (use 28-10-005-000 for Logging Debris Burning)	VII			0.02
2810001000	Miscellaneous Area Sources	Other Combustion	Forest Wildfires	Total	I	0.03	0.00	0.00
2810035000	Miscellaneous Area Sources	Other Combustion	Firefighting Training	Total	X	0.00	0.00	0.00
County Totals						**0.45**	**2.09**	**0.75**
Total State Projection					**3.28**			

Notes:

I. Delaware's 2002 emissions for this individual record were different than the MACTEC 2002 emissions. To obtain a Delaware-specific projected 2009 emission, Delaware's actual 2002 emissions for this individual record were grown and controlled using the same methodology as MACTEC in its 2009 projection for this record.

IV. Since Delaware adjusted its 2002 emissions for residential wood combustion based on a new report by OMNI, 2009 emissions had to be re-projected. Thus, Delaware's corrected 2002 emissions were projected to 2009 to 2009 using growth factors supplied by MACTEC.

VI. Due to Delaware's amendments to its open burning regulation, it is expected that emissions due to yard waste burning will decrease. Thus, Delaware has projected the 2009 emission for the SCC of 2610000500 by first recalculating the 2002 emissions as if the same control efficiency, rule effectiveness, and rule penetration used for Kent and New Castle counties were applied, and then applying the same growth factors used by MACTEC.

VII. Due to Delaware's amendments to its open burning regulation, it is expected that emissions due to land clearing debris burning will decrease. Thus, Delaware has projected the 2009 emission for the SCC of 2610000500 by first recalculating the 2002 emissions as if 90% rule effectiveness were applied, and then applying the same growth factors used by MACTEC.

X. Delaware recently amended its regulation pertaining to open burning, which extended the ozone season open burning prohibition out to May through September, and applies the prohibition to all counties in the state. Due to the regulation's amendment, there will be no approvals issued for firefighting training in any county; thus, Delaware has zeroed out those emissions.

Table 6-8. Delaware 2009 VOC and NOx Emission Projections (TPD) for Non-Point Sources Not Revised from MACTEC's Projections

County	FIPS	Non-Point Emissions	
		VOC	**NOx**
Kent	10001	2.25	0.02
New Castle	10003	8.46	0.01
Sussex	10005	3.58	0.01
State-Total		14.29	0.05

Table 6-9. Delaware 2009 VOC and NOx Emission Projections (TPD) for All Non-Point Sources

County	FIPS	Non-Point Emissions	
		VOC	**NOx**
Kent	10001	4.75	0.47
New Castle	10003	16.21	2.10
Sussex	10005	6.15	0.76
State-Total		**27.11**	**3.33**

6.3 Non-Road Mobile Source Controls and 2009 Emission Projections

The controls for non-road mobile engines (except aircrafts, locomotives, and marine vessels) for their 2009 emissions include all relevant federal rules, such as fuel sulfur content rule, gasoline Reid Vapor Pressure (RVP) requirements, and reformulated fuel programs. MACTEC used EPA's NMIM2005 model and NONROAD2005 model to estimate annual emission projections of non-road engines in all MANE_VU states, including Delaware (see MACTEC's TSD, Appendix 6-1).

In addition to the non-road engines, MACTEC also conducted 2009 annual emission projections for aircrafts, locomotives and marine vessels for all MANE_VU states. Controls for the 2009 VOC and NOx emissions include all relevant federal rules and requirements, as outline below.

(1) Phase I and Phase II Emissions Standards for Gasoline-Powered Non-Road Utility Engines, Federal Rule
This measure takes credit for VOC emissions reductions attributable to emissions standards promulgated by the EPA for small non-road, spark-ignition (i.e., gasoline-powered) utility engines, as authorized under 42 U.S.C. §7547. The measure affects gasoline-powered (or other spark-ignition) lawn and garden equipment, construction equipment, chain saws, and other such utility equipment as chippers and stump grinders, wood splitters, etc., rated at or below 19 kilowatts (an equivalent of 25 or fewer horsepower). Phase 2 of the rule applied further controls on handheld and non-handheld outdoor equipment. See References 6-2, 6-3, and 6-4.

(2) Emissions Standards for Diesel-Powered Non-Road Utility Engines of 50 or More Horsepower, Federal Rule
This measure takes credit for NOx emissions reductions attributable to emissions standards promulgated by the EPA for non-road, compression-ignition (i.e., diesel-powered) utility engines, as authorized under 42 U.S.C. §

7547. The measure affects diesel-powered (or other compression-ignition) construction equipment, industrial equipment, etc., rated at or above 37 kilowatts (37 kilowatts is approximately equal to 50 horsepower). See References 6-5, 6-6, and 6-7.

(3) Emissions Standards for Spark Ignition (SI) Marine Engines, Federal Rule
This EPA measure controls exhaust VOC emissions from new spark-ignition (SI) gasoline marine engines, including outboard engines, personal watercraft engines, and jet boat engines. Of nonroad sources studied by EPA, gasoline marine engines were found to be one of the largest contributors of hydrocarbon (HC) emissions (30 percent of the nationwide nonroad total). See Reference 6-8.

(4) Emissions Standards for Large Spark Ignition Engines, Federal Rule
This EPA measure controls VOC and NOx emissions from several groups of previously unregulated nonroad engines, including large industrial spark-ignition engines. See References 6-9 and 6-10.

(5) Reformulated Gasoline Use in Non-Road Motor Vehicles and Equipment, Federal Rule
This measure involves taking credit for reductions due to the use of federally reformulated gasoline in non-road mobile sources. Reformulated gasoline is available as a result of Delaware's reformulated gasoline requirement. See Reference 6-11.

Since aircraft, commercial marine vessels, and locomotives are not included in the NONROAD model, emission projections for these sources were developed separately. The starting point for the emission projections was Version 3 of the MANE_VU 2002 Nonroad emission inventory (*Documentation of the MANE-VU 2002 Nonroad Sector Emission Inventory, Version 3, Draft Technical Memorandum*, March 2006). MACTEC's approach to developing emission projections for these sources was to use combined growth and control factors developed from emission projections for U.S. EPA's Clean Air Interstate Rule (CAIR) development effort. MACTEC obtained emission projections developed for the CAIR rule. We then calculated the combined growth and control factors by determining the ratio of emissions between 2002 and each of the MANE-VU projection years (2009, 2012, and 2018). The CAIR emissions were available for 2001, 2010, 2015 and 2020. Thus, we developed intermediate year estimates using linear interpolation between the actual CAIR years and the MANE-VU years.

Using this approach we developed State/county/SCC/pollutant growth/control factors for use in projecting the MANE-VU base year data to the year of interest. These values were then used to multiply times the base year value to obtain the projected values. Since the development of the CAIR factors included both growth and controls, no separate control factors were developed for these sources except where exceptions to this method were used for States that requested alternative growth/control methods (see below).

Once the CAIR factors were developed, MACTEC compared the SCCs contained in the CAIR inventory with those used in MANE-VU. In some cases there were differences. In cases where a similar SCC in the CAIR inventory could be assigned to the

SCC in the MANE-VU inventory the State/County/SCC/pollutant growth and control factor for the substitute was assigned to the MANE-VU SCC. If no corresponding county SCC substitution could be found, a State or MANE-VU regional average value for the substitute SCC was developed and assigned for use in projecting emissions. The substitution scheme was to use State values first, then MANE-VU regional values if the State value couldn't be used.

Since the ozone-season-daily emissions (tons per day, or TPD) are needed for the ozone SIP planning, Delaware uses its 2002 daily-emission to annual-emission ratios to calculate 2009 daily emissions from MANE_VU's annual projections (tons per year, or TPY), assuming the daily-to-annual emission relations in 2009 follows the same pattern in 2002. These calculations were done at the SCC level, by county, and by pollutant, in order to be as precise as possible. For a small subset of SCCs, where Delaware's 2002 annual-emissions differed from MANE_VU's 2002 annual-emissions, Delaware's 2002 annual-emissions were first projected to 2009 annual-emissions using the ratio of MANE_VU's 2002 to 2009 annual-emissions ratio, prior to calculating the 2009 daily emissions. All calculations are presented in Appendix 6-2, with an example for each of VOC and NO emissions as follows.

Example 1
Calculation of Kent County 2009 Daily VOC Emission for SCC 2260001010

2002 DE Ozone-Season Daily VOC Emission: 0.17 TPD
2002 DE Annual NOx Emission: 48.00 TPY
Daily-to-Annual DE Emission Ratio: 0.17/48.00
2009 MANE_VU Annual VOC Projection: 63.99 TPY

2009 Daily VOC Emission: 63.99 x (0.17 /48.00) = 0.22 TPD

Example 2
Calculation for Kent County 2009 Daily NOx Emission for SCC 2280002100

2002 MANE_VU Annual Projection: 33.59 TPY
2009 MANE_VU Annual Projection: 32.53 TPY
2009-to-2002 MANE_VU Emission Ratio: 32.53/33.59
2002 DE Ozone-Season Daily NOx Emission: 0.07 TPD
2002 DE Annual NOx Emission: 26.48 TPY
Daily-to-Annual DE Emission Ratio: 0.07/26.48
2009 MANE_VU Annual Projection: 32.53 TPY

2009 Daily NOx Emission: [(32.53/33.59) x 26.48] x (0.07/26.48) = 0.07 TPD

A summary of Delaware 2009 emission projections for all non-road mobile sources is presented in Table 6-10.

Table 6-10. Delaware 2009 Non-Road Mobile Source Emission Projection Summary

		2009 Emissions	
County	**FIPs**	**VOC**	**NOx**
Kent	10001	4.32	14.21

New Castle	10003	8.89	22.89
Sussex	10005	7.78	12.50
State Total		**20.98**	**49.59**

6.4 On-Road Mobile Source Controls and 2009 Emission Projections

The on-road mobile source emission projections have been conducted by AQM staff members using EPA's MOBILE6.2 model. Delaware Department of Transportation (DelDOT) provided vehicle miles traveled (VMT) on Delaware's roadways and vehicle mix data for 2009. The on-road mobile source controls in the input files for the 2009 MOBILE6.2 runs include the following:

(1) Low enhanced I/M program of model years 1968 and newer, Kent and New Castle.
(2) On-Board Diagnostic checks of model years 1996 and newer, statewide.
(3) Anti-tampering program of model years of 1975 and newer, statewide.
(4) NLEV program, statewide.
(5) Low emission vehicle program/Tier 2 emission standards/low sulfur rule, statewide.
(6) Heavy Duty Diesel Rule/low Sulfur rule, statewide.
(7) Stage II vapor recovery, statewide (This control was included in MOBILE6.2 model runs for obtaining emission factors to be used emission calculations in the non-point source sector).

Table 6-11 is a summary of Delaware 2009 on-road mobile source emission projections. The input files of the 2009 MOBILE6.2 runs, the emission factors generated and relevant calculations for emission projections are presented in Appendix 6-3.

Table 6-11. Delaware 2009 On-Road Mobile Source Emission Projection Summary

		2009 Emissions	
County	**FIPS**	**VOC**	**NOx**
Kent	10001	3.95	9.04
New Castle	10003	9.89	19.23
Sussex	10005	7.05	11.93
State Total		**20.89**	**40.20**

6.5 Delaware 2009 Emission Projections for All Source Sectors

Table 6-12 is a summary of Delaware 2009 all-source emission projections.

Table 6-12. Delaware 2009 All-Source Emission Projection Summary

		2009 Emissions	
County	**FIPS**	**VOC**	**NOx**
Kent	10001	13.41	27.95
New Castle	10003	45.24	73.78
Sussex	10005	28.62	41.73

State Total		**87.27**	**143.46**

The total VOC and NOx numbers in Table 6-12 do not include the banked emissions (See Subsection 5.1.2 of this document). Additionally, Delaware commits to adopt a regulation to control the NOx emissions from large boilers and heaters from non-refinery facilities (see Subsection 6.1). This rule shall yield an approximate 3.74 TPD NOx reduction, which was not included in Subsection 6-1. Therefore, the final 2009 emission projections shall be:

2009 VOC emission = 87.27 + 0.19 = 87.46 TPD
2009 NOx emission = 143.46 + 0.35 + 0.68 – 3.74 = 140.75 TPD

As indicated in Section 4 of this document, Delaware VOC and NOx emission targets in 2009 are 85.04 TPD and 147.64 TPD, respectively. From Table 6-12 and the above calculations, it can be seen that Delaware's adopted and proposed controls in this section will achieve a VOC emission level that is higher than the target level. The 2009 VOC emission reduction "shortfall" is:

VOC reduction shortfall = 85.04 – 87.46 = -2.42 TPD

Delaware's 2002 VOC-to-NOx baseline (with respect to 2009) ratio is (38.79+72.49):(55.84+137.10) = 111.28:192.94 = 1:1.73 (See Tables 4-3 and 4-4 in Section 4). Therefore, the above VOC reduction shortfall is equivalent to 2.42 x 1.73 = 4.19 TPD NOx reduction shortfall.

From Table 6-12 and emission projection calculations thereafter, it can be seen also that Delaware's adopted and proposed controls in this section will achieve a NOx emission level that is lower than the target level. The 2009 NOx emission reduction "surplus" is:

NOx reduction surplus = 147.64 – 140.75= 6.89 TPD

According to EPA's guidance for NOx substitution (References 6-12 and 6-13), Delaware decides to use 4.19 TPD NOx reduction surplus to offset the 2009 VOC reduction shortfall. Delaware plans to use the leftover portion of NOx surplus, i.e., 6.89 – 4.19 = 2.70 TPD, for 2009 contingency purposes, as discussed in Subsection 10.3 of this SIP revision.

References

6-1. *Regulations Governing the Control of Air Pollution No. 1146 Electric Generating Unit (EGU) Multi-Pollutant Regulation*, Delaware Department of Natural Resources and Environmental Control, Dover, Delaware, December 2006.

6-2. U.S. Environmental Protection Agency, "*Emission Standards for New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts*", Final Rule, 60 *Federal Register* 34581 (July 3, 1995).

6-3. U.S. Environmental Protection Agency, "*Phase 2 Emission Standards for New Nonroad Spark- Ignition Nonhandheld Engines At or Below 19 Kilowatts*", Final

Rule, 64 *Federal Register* 15207, (March 30, 1999); correction published 64 *Federal Register* 36423 (July 6, 1999)

6-4. U.S. Environmental Protection Agency, "*Phase 2 Emission Standards for New Nonroad Spark- Ignition Handheld Engines at or Below 19 Kilowatts*", Final Rule, 65 Federal Register 24267 (April 25, 2000)

6-5. U.S. Environmental Protection Agency, "*Control of Emissions of Air Pollution from Nonroad Diesel Engines; Final Rule.*" 63 Federal Register 56967, October 23, 1998.

6-6. U.S. Environmental Protection Agency, "*Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel; Final Rule*." 69 Federal Register Vol. 69, No. 124, June 29, 2004

6-7. U.S. Environmental Protection Agency, "*Determination of Significance for Nonroad Sources and Emission Standards for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts*", Final Rule, 59 *Federal Register* 31306 (June 17, 1994).

6-8. U.S. Environmental Protection Agency, "*Control of Air Pollution; Final Rule for New Gasoline Spark-Ignition Marine Engines; Exemptions for New Nonroad Compression-Ignition Engines at or Above 37 Kilowatts and New Nonroad Spark-Ignition Engines at or Below 19 Kilowatts*", 61 Federal Register 52087, October 4, 1996.

6-9. U.S. Environmental Protection Agency, "*Control of Emissions from Nonroad Large Spark-Ignition Engines, and Recreational Engines (Marine and Land-Based),*" Final Rule, 67 Federal Register 68241 (November 8, 2002).

6-10. U.S. Environmental Protection Agency, "*Final Regulatory Support Document: Control of Emissions from Unregulated Nonroad Engines*," EPA420-R-02-022, September 2002.

6-11. U.S. Environmental Protection Agency, "*Regulation of Fuels and Fuel Additives: Standards for Reformulated Gasoline*", Proposed Rule, 58 *Federal Register* 11722, February 26, 1993.

6-12. *NOx Substitution Guidance*, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, December 1993.

6-13. *Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration*, Ozone/Carbon Monoxide Programs Branch, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711, February 18, 1994.

7. Attainment Demonstration Modeling and Weight-of-Evidence Analysis

7.1 Background and Objectives

As discussed in Section 1 of this document, EPA designated all three counties in Delaware as moderate non-attainment areas for the 8-hour ozone standard. These three Delaware counties are part of a greater Philadelphia-Wilmington-Atlantic City (PA-NJ-DE-MD) moderate non-attainment area (NAA) for the 8-hour ozone standard. As shown in Figure 1-1 (Section 1 of this document), the moderate non-attainment counties within this area by the state are:

Delaware:	Kent County, New Castle County, Sussex County;
Maryland:	Cecil County;
New Jersey:	Atlantic County, Burlington County, Camden County, Cape May County, Cumberland County, Gloucester County, Mercer County, Ocean County, Salem County;
Pennsylvania:	Bucks County, Chester County, Delaware County, Montgomery County, Philadelphia County.

Ozone has been a chronic problem, particularly along the I-95 corridor from Washington, DC to Boston, MA. The ozone non-attainment in the Northeast and Mid-Atlantic regions is attributed not only to the anthropogenic emissions in the area but also to regional transport, which is a significant portion of ozone observed. The Ozone Transport and Assessment Group (OTAG) addressed the concerns related to ozone transport through modeling, which determined that NOx emissions reductions are effective in reducing the ozone transport (Reference 7-1). Consequently, the EPA issued the NOx SIP call in 1998 requiring twenty-two states and the District of Columbia to reduce their NO_x emissions. The control programs for the NOx SIP Call were implemented in phases, with the full implementation occurring in 2005 (Reference 7-2). While the NOx SIP call measures helped mitigate the regional ozone transport along the I-95 corridor (References 7-2 and 7-3), regional transport is still a major contributor to the continuing ozone non-attainment in the Mid-Atlantic and Northeast.

The EPA requires that the areas in non-attainment for the 8-hour ozone NAAQS demonstrate, by the use of photochemical grid modeling and weight-of-evidence analyses, that they would attain the NAAQS by June 15, 2010 (Reference 7-4). The attainment demonstration assesses whether emissions reductions resulting from a set of selected control measures will result in ambient concentrations that meet the NAAQS. It predicts whether or not all estimated future 2009 design values will be less than or equal to the concentration level specified for the 8-hour ozone NAAQS under meteorological conditions similar to those which have been simulated for the 2002 base year modeling.

The objective of this section (i.e., Attainment Demonstration Modeling and Weight-of-Evidence Analysis) is to evaluate the efficacy of proposed/adopted control strategies, and to demonstrate that such measures will result in attainment of the ozone standard by June 15, 2010. This SIP shows that progress is being made to improve air quality in the PA-NJ-DE-MD moderate non-attainment area, that all necessary steps are being taken to attain the 8-hour ozone NAAQS by 2009, and that the entire non-attainment area will comply with the 8-hour ozone NAAQS by the June 15, 2010 attainment date.

The basis for Delaware's attainment demonstration for the 8-hour ozone standard is the Delaware modeling protocol (Reference 7-5) and Ozone Transport Commission's (OTC) modeling for the State Implementation Plan (SIP) in the 12-state Ozone Transport Region (OTR) (Appendix 7-1). The PA-NJ-DE-MD's modeling runs were performed in coordination with the OTC modeling centers, which included the New York State Department of Environmental Conservation (NYSDEC), the University of Maryland, the Northeast States for Coordinated Air Use Management (NESCAUM) and Virginia Department of Environmental Quality (VADEQ). Modeling inventories were developed, updated and shared among the regional modeling centers and provided by Mid-Atlantic Regional Air Management Association (MARAMA), Mid-Atlantic North East Visibility Union (MANE-VU) and the Visibility Improvement State and Tribal Association of the Southeast (VISTAS).

7.2 Photochemical Modeling System

The OTC modeling committee selected the EPA's Community Multi-Scale Air Quality (CMAQ) model for this modeling effort. Two CMAQ modeling domains were defined: the outer domain at a 36-km horizontal grid resolution covering the continental U.S. and the inner domain at 12-km horizontal grid resolution covering the OTR, as shown in Figure 7-1. The outer domain with 36-km horizontal grid resolution is the same national grid adopted by the Regional Planning Organizations (RPOs) for the original purpose of modeling regional haze SIP demonstrations but also serving the purpose of ozone evaluation. However, the inner domain, with 12-km horizontal grid resolution in the northeastern U.S., is the focus of and the justification for all activities pursuant to demonstrating attainment of the 8-hour ozone standard. The selection of the horizontal grid sizes and vertical layer structure are described in detail in the OTC Modeling Protocol (Appendix 7-1). A technical support document from NYSDEC (Appendix 7-2) provides information on air quality modeling domain definitions, CMAQ model options selected for modeling, and 36- and 12-km CMAQ domain simulations.

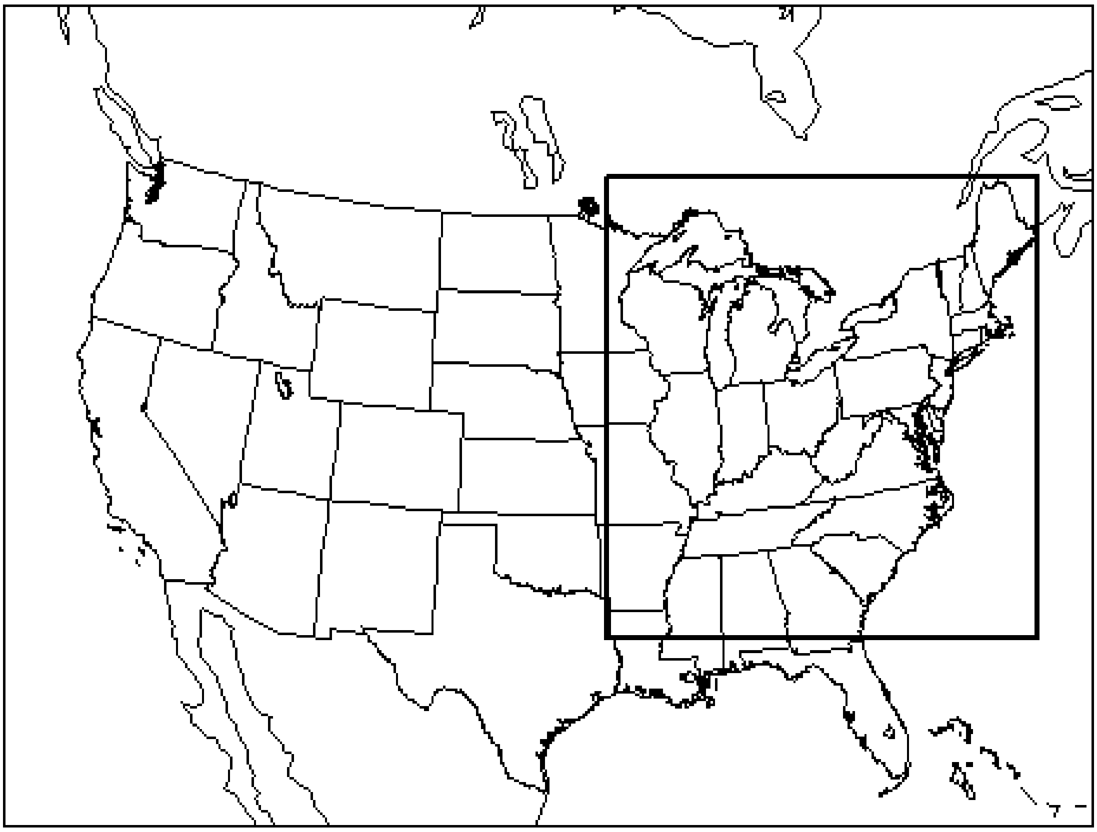

Figure 7-1: The 8-Hour Ozone CMAQ Modeling Domains at 36-km and 12-km

7.3 Ozone Episode Selection

The EPA recommends modeling a group of episodes for the purposes of attainment demonstration. Taking the size of the modeling domain into consideration, the OTC modeling committee simulated a major portion of the 2002 ozone season with the OTC SIP modeling system. Such a selection is justified as a result of a special study by Environ (Appendix 7-3), which assesses the representativeness of the conditions in 2002 season with respect to exceedance events that have occurred in other years, and determines if there are any types of episodes that are not adequately represented within the 2002 season. The Environ study analyzed the ozone episodes and concluded that conditions during the 2002 exceedance events were, for the most part, very similar to those found in other years, and that the 2002 season can be considered to be representative for purposes of photochemical modeling in support of SIP development. Another study, a qualitative analysis by Ryan and Piety (Appendix 7-4), provides the rationale for the selection of 2002 meteorology.

Recent research has shown that model performance evaluations and the response to emissions controls need to consider modeling results from long time periods, in particular full synoptic cycles or even full ozone seasons. Based on this factor the entire ozone season was simulated for the 2002 and 2009 State Implementation Plan (SIP) modeling runs (May 1 to September 30). As a result, the total number of days examined for the complete ozone season far exceeds EPA recommendations, and provides for better assessment of the simulated pollutant fields.

7.4 Meteorological Fields

Meteorological fields needed for the OTC SIP modeling system are generated by the PSU/NCAR Mesoscale Meteorological Model (MM5). The model setup and the procedures for quality assurance of the meteorological fields are described in the OTC Modeling Protocol (Appendix 7-1). Assessment of the MM5 modeling is described in Appendix 7-5.

7.5 Model Performance Evaluation

The purpose of the evaluation of model performance is to assess the model's ability to reproduce the observations at all monitored locations. This is a required step in order to build confidence in the model prior to its use in control strategy evaluation and modeled attainment demonstrations. The model performance evaluation focused on the magnitude, spatial and temporal patterns of the modeled and monitored concentrations of ozone and its precursors. The EPA procedures are used to calculate the recommended performance measures (Appendix 7-1).

Various CMAQ model evaluation statistics for a variety of gaseous and aerosol species are assessed for many possible sources of measured data in the OTR. The CMAQ results were best for daily maximum (Appendix 7-6). Our evaluation of model performance for monitored ozone concentrations in Delaware monitors satisfied the EPA criteria.

7.6 Emissions Inventories

Emissions processing necessary for the 2002 base case and 2009 future case modeling required coordination amongst the Regional Planning Organizations (RPOs). Each RPO was responsible for processing of both its anthropogenic and biogenic emissions. The emissions data for 2002 were generated by individual states within the OTR and were assembled and processed through the MANE-VU. These emissions were then processed by the NYSDEC using Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system, an emissions processor for CMAQ, to provide model-ready inputs. The 2002 emissions for the non-OTR areas within the modeling domain were obtained from the corresponding RPOs and were processed using SMOKE.

Emissions inventories for 2009, 2012 and 2018 needed for the MANE-VU RPO were developed by a number of entities. A contractor (MACTEC, Inc.) in consultation with the states developed the necessary growth and control factors and applied them to the 2002 inventory. Mobile source emissions were developed by VADEQ and NESCAUM based on state supplied VMT and speeds data. Emissions for the electric generating units (EGUs) the inter-RPO workgroup developed the state and unit-level emissions by utilizing the Integrated Planning Model (IPM). The 2009 emissions inventories utilized in modeled attainment demonstrations identified as 2009 on-the-book/on-the-way (2009 OTB/OTW) inventories as they represent all control measures that were promulgated or would become effective on or before 2009. Details of emissions processing are provided in Appendices 7-7, 7-8 and 7-9.

7.7 Conceptual Model

EPA recommends that a conceptual description of the area's ozone problem be developed prior to the initiation of any air quality modeling study. A "conceptual description" is a qualitative way of characterizing the nature of an area's non-attainment problem. Within the conceptual description of a particular modeling exercise, it is recommended that the specific meteorological parameters that influence air quality be identified and qualitatively ranked in importance. The conceptual model that Delaware is using for this SIP revision is a report that was prepared by the NESCAUM for use by the OTC member States (Appendix 7-10). This document provides the conceptual description of the ozone problem in the OTR states, consistent with the EPA's guidance.

There are a number of other studies that provide conceptual description for the ozone problem in the Northeast and Mid-Atlantic regions. Some of them are provided as appendixes to this document (Appendixes 7-3, 7-4, 7-11, and 7-12).

7.8 Attainment Demonstration of 8-hour Ozone NAAQS

This subsection provides technical information and rationale for demonstrating attainment of the 8-hour ozone NAAQS in the PA-NJ-DE-MD moderate non-attainment area by June 15, 2010. The demonstration is based on results of CMAQ modeling and the supporting weight-of-evidence (WOE) analyses, details of which are as follow.

7.8.1 Modeling Demonstration

Modeled attainment demonstration of the NAAQS is performed in two ways: by applying modeled attainment test for all monitors in the area, and by utilizing the "unmonitored area analysis" per the EPA Modeling Guidance document.

7.8.1.1 Model Results Summary

The modeled attainment test applied at each monitor is performed using the following equation:

$$DVF_I = RRF_I \times DVC_I$$

where DVC_I = the baseline concentration monitored at site I, in ppb;
RRF_I = the relative response factor, calculated near site I ;
DVF_I = the estimated future design value for the time attainment is required, in ppb.

Results for all monitors inside the PA-NJ-DE-MD moderate non-attainment area are summarized in Table 7-1. This table includes baseline design values (DVC) for all monitors. These values are based on the 8-hour ozone design values and relative response factors (RRFs) from the OTC SIP-quality modeling. The projected design values for 2009 (DVF) represent the projected 2009 8-hour ozone design values. Highlighted values indicate the monitors projected to be above the 8-hour ozone standard at the end of the 2009 ozone season.

Baseline design values (DVC) are calculated using the average of the three design value periods that include the baseline inventory year. Specifically, the average design value is calculated using the 2000-2002, 2001-2003, and 2002-2004 periods.

In the event that there is less than five years of available data at a monitoring site the following procedure was used:

- 3 years of data: The current design value was based on a single design value.
- 4 years of data: The current design value was based on an average of two design value periods.
- Less than 3 years of data: The site was not be used in the attainment test.

A 3x3 array of grid cells surrounding each monitor was used in the modeled attainment test as recommended for 12-km grid resolution modeling to calculate RRFs.

The predicted eight-hour daily maximum concentrations from each modeled day is used in the modeled attainment test with the nearby grid cell with the highest predicted 8-hour daily maximum concentration with baseline emissions for each day considered in the test, and the grid cell with the highest predicted 8-hour daily maximum concentration with the future emissions for each day in the test.

Table 7-1: Summary of Model Attainment Test Results

Monitor ID	Site Name	County	State	DVC	RRF OTB/OTW V4	DVF
100010002	Killens Pond	Kent	DE	88	0.8934	78
100031007	Lums Pond	New Castle	DE	91	0.8462	77
100031010	Brandywine	New Castle	DE	93	0.8781	81
100031013	Bellefonte	New Castle	DE	89	0.8759	77
100051002	Seaford	Sussex	DE	90	0.8462	76
100051003	Lewes	Sussex	DE	86	0.8956	77
240150003	Fair Hill	Cecil	MD	98	0.8336	81
340010005	Nacote Creek	Atlantic	NJ	88	0.8762	77
340070003	Camden	Camden	NJ	98	0.8996	88
340071001	Ancora State Hospital	Camden	NJ	100	0.8733	87
340110007	Millville	Cumberland	NJ	94	0.8486	79
340150002	Clarksboro	Gloucester	NJ	98	0.9004	88
340210005	Rider College	Mercer	NJ	97	0.8908	86
340290006	Colliers Mills	Ocean	NJ	105	0.8703	91
420170012	Bristol	Bucks	PA	99	0.8976	88
420290100	New Garden Airport	Chester	PA	94	0.8387	78

Monitor ID	Site Name	County	State	DVC	RRF OTB/OTW V4	DVF
420450002	Chester	Delaware	PA	91	0.8705	79
420910013	Norristown	Montgomery	PA	92	0.8861	81
421010004	AMS Lab	Philadelphia	PA	72	0.9081	65
421010014	Roxboro	Philadelphia	PA	91	0.9070	82
421010024	NE Airport	Philadelphia	PA	97	0.9035	87
421010136	Elmwood	Philadelphia	PA	84	0.9070	76

The RRFs used in the modeled attainment test were computed by taking the ratio of the mean of the 8-hour daily maximum predictions in the future to the mean of the 8-hour daily maximum predictions with baseline emissions, over all relevant days.

To avoid overestimates of future design values and provide for more robust RRFs and future design values, the following rules were applied to determine the number of days and the minimum threshold at each ozone monitor:

- If there are 10 or more days with daily maximum 8-hour average modeled ozone > 85 ppb an 85 ppb threshold was used.
- If there are less than 10 days with daily maximum 8-hour average modeled ozone > 85 ppb the threshold was reduced to as low as 70 ppb until there are 10 days in the mean RRF calculation.
- If there are less than 10 days with daily maximum 8-hour average modeled ozone > 70 ppb then all days > 70 ppb were used.
- No RRF calculations were performed for sites with less than 5 days > 70 ppb.

7.8.1.2 Unmonitored Area Analysis

The purpose of the unmonitored area analysis is to insure that there are no predicted violations of ambient air quality standards in the non-attainment area areas. This analysis was prepared in accordance with the EPA modeling guidance document (2005). For the purposes of this analysis, all counties within the PA-NJ-DE-MD non-attainment area and all counties that bordering this area are considered.

The baseline data for this analysis is the ozone model data 2002 BaseB1 dataset, which contains the daily maximum 8-hour ozone concentrations, for each grid cell in the modeling domain, simulated by CMAQ for May 15 September 29 using 2002 BaseB1 emissions data. The projected data uses the ozone model data 2009 BaseB4 dataset, which contains the for the 2009 BaseB4 BOTB/BOTW scenario data for the same period. Both of these datasets were generated by the New York DEC using the SMOKE/CMAQ modeling system with MM5 meteorology.

Processing of the data was done with MATS version 1.1.043 (February 2007). This involved four steps:

Step 1: Interpolating the base year ambient data to the spatial fields.
Step 2: Adjusting the spatial fields using the base year gridded model output gradients.
Step 3: Applying the gridded model Relative Response Values to the gradient adjusted spatial fields.
Step 4: Determining if any unmonitored areas exceed the NAAQS.

As shown in Figure 7-2, no grid cells in this analysis are predicted to exceed the 8-hour ozone NAAQS.

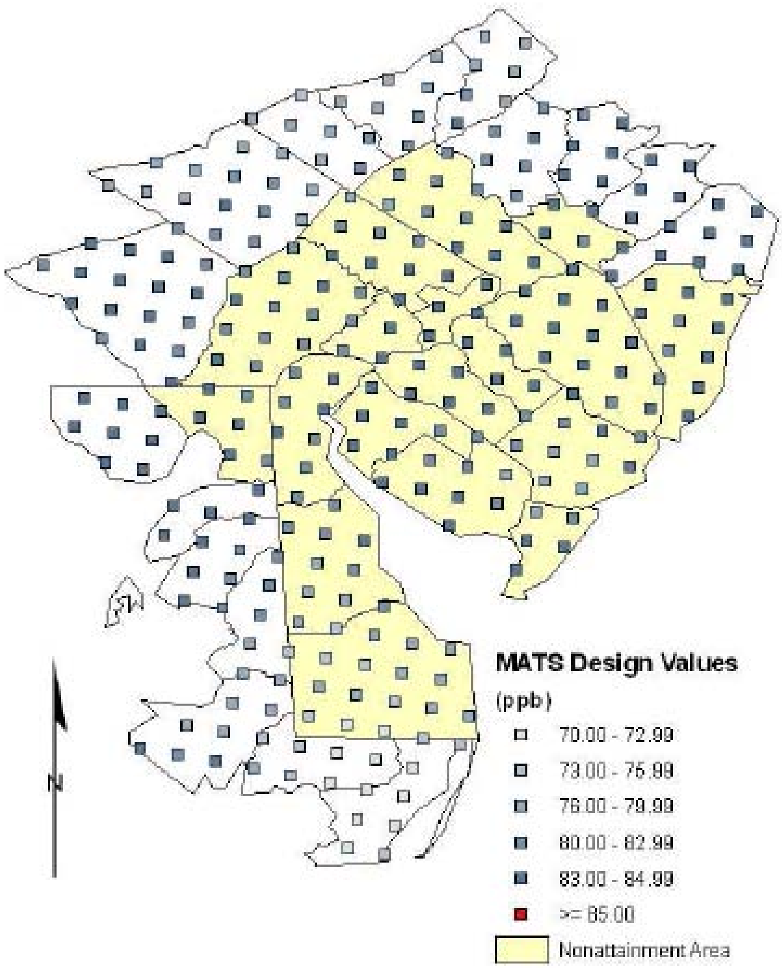

Figure 7-2: Predicted ozone design values

7.8.2 Weight of Evidence Demonstration

In accordance with EPA guidance, corroboratory evidence shall accompany the modeled attainment demonstration. This weight of evidence (WOE) analysis describes the analyses performed, databases used, key assumptions and outcomes of each analysis, and why the evidence, viewed as a whole, supports a conclusion that the non-attainment area will attain the NAAQS despite the model predicting that some monitors' future design values will exceed the 8-hour ozone standard (see Section 7.8.1 above).

Table 7-2 outlines under what circumstances a WOE demonstration is needed. Model-predicted design values are summarized in Table 7-1. Of the 22 ozone monitors in the PA-NJ-DE-MD non-attainment area only eight (8) exceed the threshold requiring a WOE demonstration. Four (4) of the monitors fall within the 82-97 ppb threshold outlined in Table 7-2 and four (4) others fall within the last category listed in the WOE table included in the US EPA guidance. The Roxboro monitor has been excluded from the WOE analysis since its current design value is significantly below the 8-hour standard (modeled 82 ppb, actual 78 ppb).

Table 7-2 Guidelines for Supplemental Analyses and Weight of Evidence Determinations

Results of Modeled Attainment Test	**Supplemental Analyses**
Future Design Value < 82 ppb, all monitor sites	Basic supplemental analyses should be completed to confirm the outcome of the modeled attainment test
Future Design Value 82 - 87 ppb, at one or more sites/grid cells	A weight of evidence demonstration should be conducted to determine if aggregate supplemental analyses support the modeled attainment test
Future Design Value > 88 ppb, at one or more sites/grid cells	More qualitative results are unlikely to support a conclusion differing from the outcome of the modeled attainment test.

The WOE analysis for the remaining seven monitors will include the following analyses:

- A comparison of predicted 2009 ozone design values and current projected design values for 2006 (Section 7.8.2.1, Overview of Modeled Concentrations and Current Design Values),
- An analysis of recent ozone trends in the PA-NJ-DE-MD non-attainment area (Section 7.8.2.2., Recent Ozone Trends),
- Alternative methods for calculating the 2009 ozone design value (Section 7.8.2.3., Alternative Approaches, and 7.8.2.4, Combining Alternative Baseline Concentrations and Alternative RRFs)
- An analysis of model-predicted regional transport, (Section 7.8.2.5, Regional Transport Analysis)
- University of Maryland's analysis of model sensitivity to emission changes. (Section 7.8.2.6)
- Effect of alternative methods and transport on 2009 design values (Section 7.8.2.7)
- Delaware-specific control measures (Section 7.8.2.8)
- Statistical rollback to estimate RRFs (Section 7.7.2.10)

7.8.2.1 Overview of Modeled Concentrations and Current Design Values

Table 7-3 lists the OTC modeled 2009 projected design values and the projected design values for 2006. Modeled 2009 and projected 2006 design values are surprisingly close to one another with most modeled concentrations slightly lower than the projected 2006 design values. This suggests that the significant additional VOC and NOX reductions projected to occur over the next three years will likely bring monitors currently recording ozone concentrations just over the 8-hour ozone standard into compliance, and indicates attainment will be achieved.

Table 7-3 Comparison of Modeled 2009 and Projected 2006 Ozone Design Values

AQS Code	Site Name	State	Modeled 2009	Actual 2006
100010002	Killens Pond	DE	78	80
100031007	Lums Pond	DE	77	78
100031010	Brandywine Creek	DE	81	82
100031013	Bellefonte	DE	77	81
100051002	Seaford	DE	76	80
100051003	Lewes	DE	77	82
240150003	Fairhill	MD	81	90
340010005	Nacote Creek	NJ	77	79
340070003	Camden	NJ	88	84
340071001	Ancora State Hospital	NJ	87	89
340110007	Millville	NJ	79	84
340150002	Clarksboro	NJ	88	86
340210005	Rider	NJ	86	87
340290006	Colliers Mills	NJ	93	93
420170012	Bristol	PA	88	86
420290100	New Garden	PA	78	86
420450002	Chester	PA	79	83
420910013	Norristown	PA	81	85
421010004	Lab	PA	65	63
421010014	Roxboro	PA	82	78
421010024	Northeast Airport	PA	87	90
421010136	Elmwood	PA	76	74

7.8.2.2 Recent Ozone Trends

Long-term trends in Delaware's ozone design values are discussed in Section 2 of this document. Similar to this DE data there have been significant declines in the PA-NJ-DE-MD non-attainment area's 8-hour ozone design values over the last several decades. These declines are attributable to such events as the RVP program in the early 1990's and the more recent enactment of the NO_x SIP Call.

It is interesting to note that ozone design values in the PA-NJ-DE-MD non-attainment area have fallen roughly 14% since enactment of the NO_x SIP Call. Figure 7-3 shows the most recent design value trends in the PA-NJ-DE-MD non-attainment area. Nearly all of the monitors show steady decline in ozone design values since 2002 (the year prior to phased-in enactment of the NO_x SIP Call). Slight increases in design values between 2002 and 2003 occur at only a handful of monitors in the PA-NJ-DE-MD non-attainment area.

This indicates that reduction in NO_x emissions from upwind electric generating units (EGUs) have a dramatic effect on reduction of ozone levels in the PA-NJ-DE-MD non-attainment area. By 2009 additional significant reductions in NO_x emissions are projected to occur due to initiatives like CAIR and Delaware's Regulation No. 1146. These reductions are greater than those attributable to the NO_x SIP Call, so this, coupled with the significant mobile source sector reductions anticipated will provide additional reductions in the PA-NJ-DE-MD non-attainment area's design values. This should result in attainment of the 8-hour ozone standard in the PA-NJ-DE-MD non-attainment area.

Figures 7-4, 7-5 and 7-6 provide additional information on the long-term trend of summer 1-hour ozone values (1996-2006) monitored at different locations in Kent, New Castle and Sussex Counties. The long-term trends are obtained by filtering the high frequency and noise with the KZ365,3 filter of the log 1-hour ozone values (References 7-6, 7-7, 7-8). This provides the raw ozone trends, which indicates that the trend is of decreasing ozone at these three monitors. A comprehensive trends study of the 1-hour ozone concentrations over the entire OTR modeling domain shows of decreasing ozone trend at the monitors in the OTR region (Appendix 7-13).

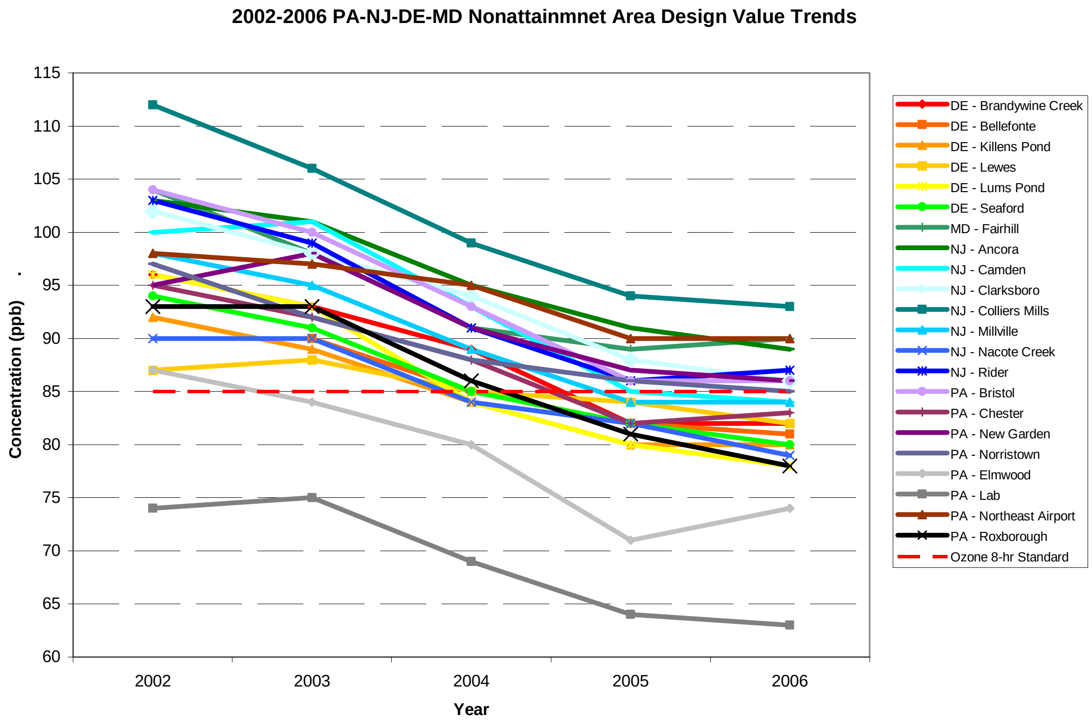

Figure 7-3. The 8-Hour Ozone 2002-2006 Design Value Trends

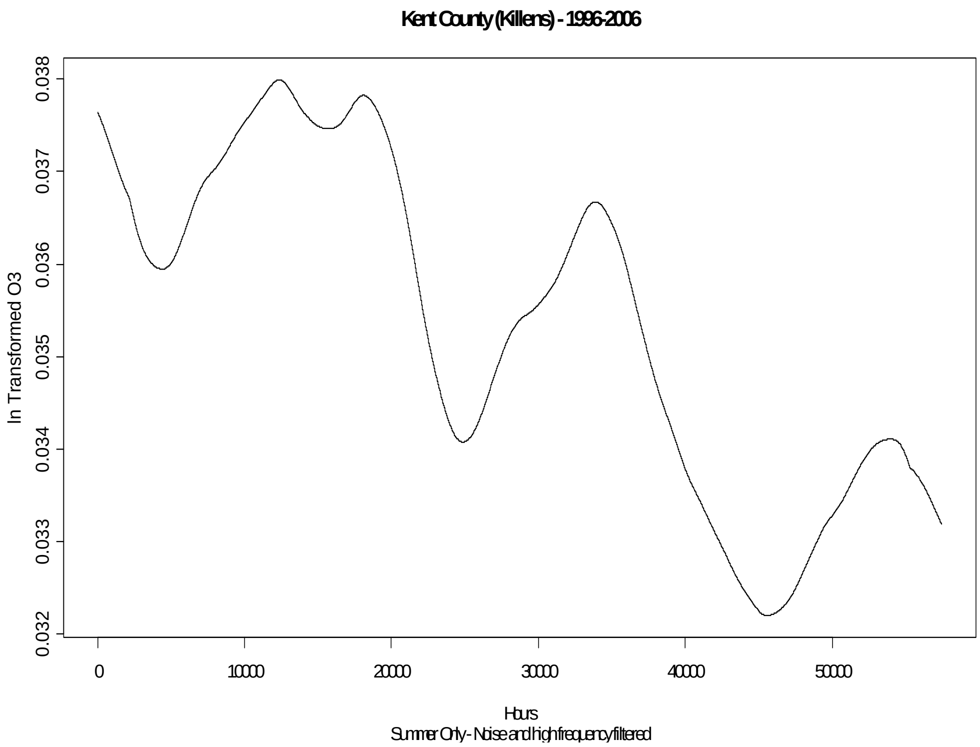

Figure 7-4. Long-term trends of ozone summer values in Kent County (1996-2006)

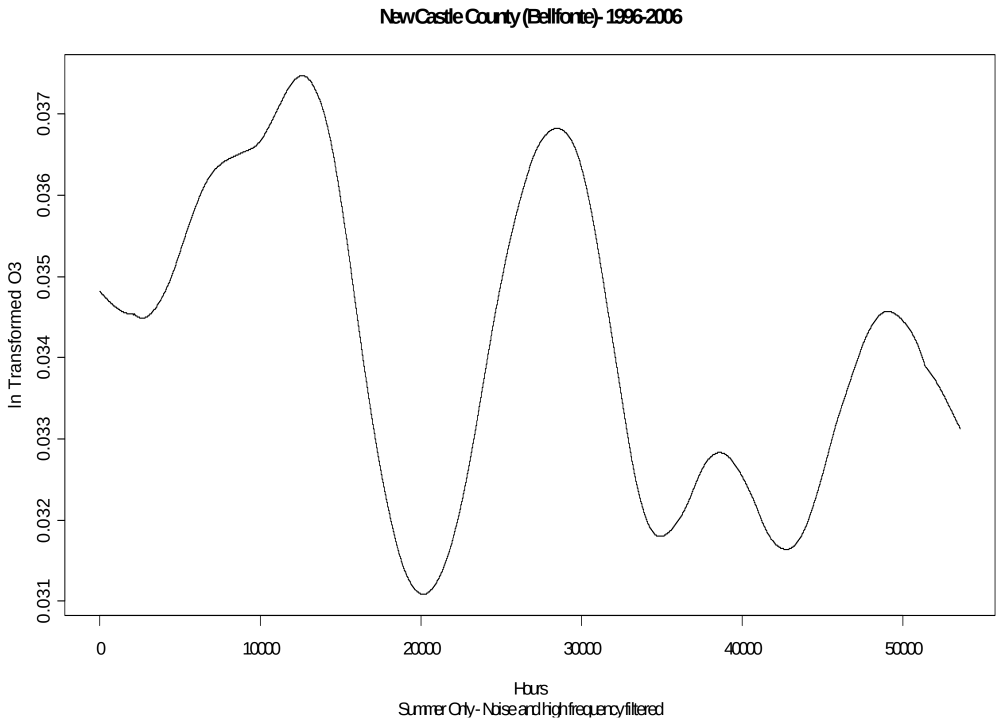

Figure 7-5. Long-term trends of Ozone Summer Values in New Castle County (1996-2006)

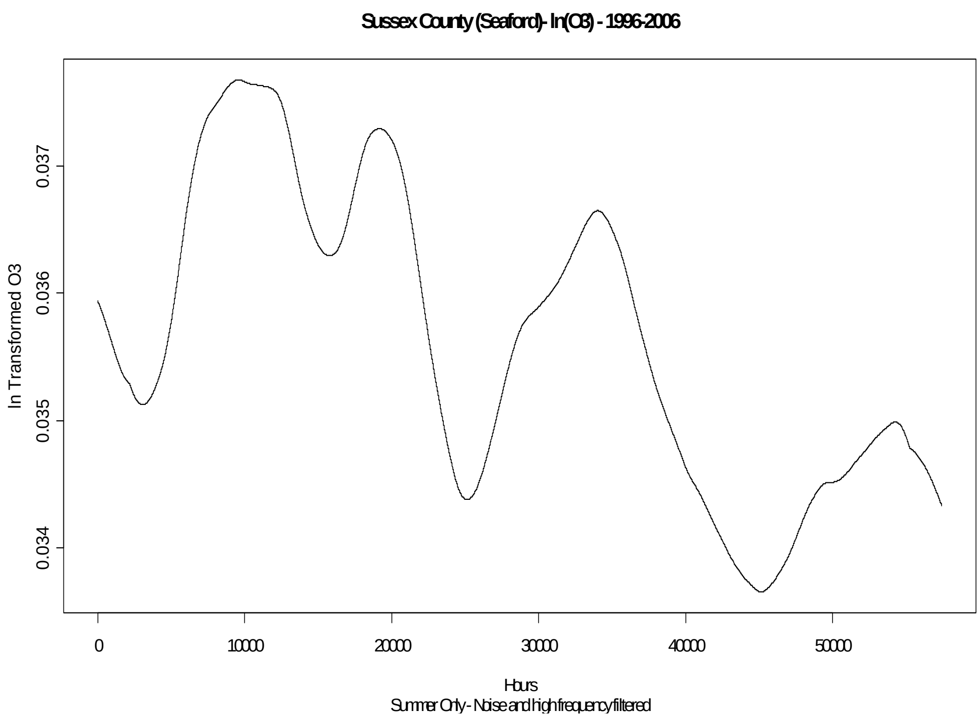

Figure 7-6. Long-term trends of Ozone summer values in Sussex County (1996-2006)

7.8.2.3 Alternative Approaches

Two alternatives to the US EPA's standard method for estimating future monitor design values are examined in this section. One assesses an alternative method for calculating the baseline design value, and another assesses constructing an alternative RRF. The effects of both methods are analyzed separately and then analyzed and combined (see Section 7.8.2.4).

Alternative Baseline Design Value

Seven monitors within the PA-NJ-DE-MD non-attainment area are projected to exceed the current 8-hour ozone standard following the US EPA's recommendations (See Section 7.8.1.1 above). The recommended baseline concentration used in the attainment demonstration is the average of the 8-hour ozone design values that include in the emission base year (2002). Thus the baseline concentration is the average of the 2002, 2003 and 2004 8-hour ozone design value.

Using the US EPA recommended method for calculating a monitor's baseline concentration places undo weight on the 2002 ozone season, one of the worst ozone seasons since the late 1990s. The 2002 ozone season contributes a third of the baseline concentration; 2001 and 2003 contribute 22% each, 2000 and 2004 contribute 11% each.
An alternative to the US EPA's method of baseline concentration calculation is to take the straight average of the 4^{th} highs over the same years (2000-2004). This approach weighs each year equally. Table 7-4 lists the alternative baseline value and the projected 2009 concentration for the seven monitors that are projected to exceed the current 8-hour ozone standard in 2009. This reduces the modeled 2009 values slightly but still leaves them close to the projected 2006 design values. Only one monitor (Colliers Mills) remains above the most difficult concentrations listed in the US EPA's WOE cut offs.

Table 7-4. Alternative Baseline Concentration Analysis

Site Name	State	Alternative Baseline	OTW/OTB V4 RRF	Alternate 2009	2006 Design Value
Camden	NJ	94	0.8996	84	84
Ancora State Hospital	NJ	98	0.8733	85	89
Clarksboro	NJ	96	0.9004	86	86
Rider College	NJ	95	0.8908	85	87
Colliers Mills	NJ	105	0.8703	91	93
Bristol	PA	96	0.8976	86	86
NE Philadelphia	PA	94	0.9035	84	90

Alternative RRF

The OTC model data was reexamined to determine the variation in RRFs for the seven monitors in which modeled 2009 concentrations exceeded the current eight-hour ozone standard. RRFs are recalculated for several different ozone levels; 2002 baseline model concentrations ≥ 85 ppb, 2002 baseline model concentrations ≥ 90 ppb and 2002 baseline model concentrations ≥ 95 ppb. The idea is to see if the air-quality model predicts more reductions on days with higher ozone concentrations (more benefit on the worst days). Table 7-5 lists the different RRFs based on the 2002 baseline model concentrations.

Recalculating the projected modeled 2009 design values using the alternative RRFs lowered nearly all seven monitors by 1 ppb, except Bristol and Colliers Mills which were unchanged (Table 7-6). The Bristol and Colliers Mills monitors remained above the most difficult concentrations listed in the US EPA's WOE cut offs.

Table 7-5. Alternative RRF Calculation Analysis

Site	**RRF ≥ 95 ppb**	**RRF ≥ 90 ppb**	**RRF ≥ 85 ppb**	**RRF ≥ 75 ppb**	**Min**
Camden	0.8915	0.8946	0.8996	0.9036	0.8915
Ancora State Hospital	0.8723	0.8749	0.8733	0.8760	0.8723
Clarksboro	0.8875	0.8894	0.9004	0.8953	0.8875
Rider	0.8914	0.8941	0.8908	0.9022	0.8908
Colliers Mills	0.8726	0.8704	0.8703	0.8757	0.8703
Bristol	0.8892	0.8925	0.8976	0.9060	0.8892
NE Airport	0.8991	0.9031	0.9035	0.9108	0.8991

Table 7-6. Alternative Projected 2009 Modeled Values Using Alternative RRFs

Site	**Alt RRF**	**DV Base**	**Alt Projected 2009**	**2006 Design Value**
Camden	0.8915	98	87	84
Ancora S.H.	0.8723	100	87	89
Clarksboro	0.8875	98	86	86
Rider	0.8908	97	86	87
Colliers Mills	0.8703	105	91	93
Bristol	0.8892	99	88	86
NE Airport	0.8991	97	87	90

7.8.2.4 Combining Alternative Baseline Concentrations and Alternative RRFs

Table 7-7 lists the projected 2009 modeled design values from combining the alternative baseline concentrations and the alternative RRF calculations described in the previous section. The combination of these two alternative approaches lowers the projected 2009-modeled concentrations significantly, but still leaves the Colliers Mills monitor above the most difficult concentrations listed in the US EPA's WOE chart. The other six monitors are close to the current eight-hour ozone standard but for the most part not significantly different than the projected 2006 design values.

Table 7-7. Combined Affects of Alternative Baseline Concentrations and Alternative RRFs

Site	Alt RRF	Alt DV Base	Alt Projected 2009	2006 Design Value
Camden	0.8915	94	83	84
Ancora State Hospital	0.8723	98	85	89
Clarksboro	0.8875	96	85	86
Rider	0.8908	95	84	87
Colliers Mills	0.8703	105	91	93
Bristol	0.8892	96	85	86
NE Airport	0.8991	94	84	90

7.8.2.5 Regional Transport Analysis

The NO_x SIP Call reduced ozone precursor emissions over a large region of the eastern US. These reductions undoubtedly reduced regional transport from the large power plants along the Ohio River into the PA-NJ-DE-MD non-attainment area. Methodist Hill is an elevated monitoring site on South Mountain in south-central Pennsylvania approximately 40 miles southwest of the City of Harrisburg. Methodist Hill sits at approximately 1900ft above mean-sea level and is in a good position to sample ozone concentrations entering the eastern OTR.

A quick review of design value trends at Methodist Hill shows substantial reductions in ozone levels since full implementation of the NO_x SIP Call. Table 7-8 lists Methodist Hill's eight-hour ozone design values, 4th high eight-hour ozone concentrations and the number of days the monitor exceeded the current eight-hour ozone standard. All of the values listed in the table have fallen since enactment of the NO_x SIP Call (2003 ozone season). Ozone design values have fallen ~15%, 4th high values have fallen ~23% and exceedances have fallen ~95% since 2003.

Table 7-8. Methodist Hill Statistics, Proxy for Regional Transport

Year	Design Value (ppm)	4th high (ppm)	No. of Exceedances
1996		0.082	3
1997		0.091	7
1998		0.104	22
1999	0.097	0.098	20
2000	0.095	0.085	4
2001	0.092	0.095	15

Year	Design Value (ppm)	4th high (ppm)	No. of Exceedances
2002	0.094	0.104	27
2003	0.093	0.080	3
2004	0.085	0.071	0
2005	0.075	0.074	0
2006	0.070	0.066	0

One way to gauge how well the OTC air-quality model is simulating regional transport is to examine how well the modeled 2009 8-hour ozone design value compares to the actual 2006-design value. Table 7-9 lists the US EPA derived modeled 2009 concentration and the actual 2006 ozone design value. The model appears to be significantly over predicting Methodist Hill's design value by approximately 6 ppb. This indicates the model is not adequately characterizing the effects of the NO_x SIP Call on upwind sources (under predicting the benefit). This suggests modeled 2009 design values may be overestimated by as much as 6 ppb within the PA-NJ-DE-MD non-attainment area. The 6 ppb difference represents the overestimation of background (regional) concentrations entering the eastern OTR.

Table 7-9 Modeled 2009 Ozone Design Values (ppb) at Methodist Hill

EPA Baseline	RRF OTB/OTW V4	Modeled 2009	DV 2006
90	**0.8488**	**76**	**70**

Though ozone concentrations entering the eastern OTR are significantly lower since the NO_x SIP Call, they still represent a significant portion of the current eight-hour standard; almost 80% on the worst ozone days within the non-attainment area.

7.8.2.6 Analysis of Air-Quality Model Sensitivity to Emission Changes

Recent work by the University of Maryland to estimate uncertainty in the CMAQ model has determined a tendency in the model to under predict emission reduction benefits (Reference 7-9). This conclusion is based on modeling work done to reproduce ozone concentrations during the August 2003 Northeast Blackout and ongoing studies by the US EPA.

Modeling work to simulate the August 2003 Northeast Blackout by Hu, Odman and Russell indicate that air-quality models significantly under predicted ozone concentrations when compared to aircraft measurements made by the University of Maryland (Reference 7-10, Appendix 7-11). Modeled ozone reductions due to the large number of power plant shutdowns during the blackout were on the order of 2.2 ppb while reductions of up to 7 ppb were noted in the aircraft data. The University of Maryland concluded air-quality models such as CMAQ might under predict ozone reductions due to control programs such as the NO_x SIP Call by up to a factor of two. To account for

CMAQ’s resistance to change, CMAQ’s benefits could be increased by 50%; in other words a factor of 1.5 will provide a conservative estimate of the WOE benefit.

Furthermore, two other sources of uncertainty in future year projection years are considered. Variations in meteorology lead to substantive variations in year-to-year peak ozone values. Therefore, selection of one base year or any three-year period that is representative of overall conditions of one area is a source of uncertainty. Currently, most ozone monitoring locations throughout the Mid-Atlantic and Northeast show improving trends in ozone concentrations over the years that went into the 5-year weighted average, though the design values at some have risen modestly. The average difference between the highest and lowest 3-year design values is 6 ppb. Similarly, the average standard deviation for each site over this time period is +/- 3 ppb. Both these measures suggest that variations in meteorology can reasonably be expected to produce substantial variability in the design values themselves.

Another source of uncertainty is the sensitivity of the model to errors and uncertainties in the emissions inventories. The scenarios used to examine this source of uncertainty were: OTC base A and base B modeling, and VISTAS model outputs at overlapping monitors. The average range across the modeling domain is approximately +/- 0.8 ppb.

The two uncertainties above can be combined to give a conservative estimate of the uncertainty in future year projections. Standard error propagation techniques can be used, namely by squaring and adding the uncertainties, and taking the square root of the sum to get the combined uncertainty. The combination gives an uncertainty in future year design values of 3.1 ppb.

7.8.2.7 Effect of Alternative Methods, Transport and Model Underpredictions on 2009 Design Values

Delaware has performed a WOE analysis for all of the monitors within the PA-NJ-DE-MD non-attainment area whose modeled 2009 8-hour ozone design values exceed 82 ppb. There are twenty-two (22) ozone monitors currently operating in the PA-NJ-DE-MD non-attainment area. Of these monitors, only eight have modeled 2009 concentrations above 82 ppb. This by itself represents a significant improvement in air quality.

Of the eight monitors requiring a WOE analysis, two monitors (Roxboro and Camden) have 2006 design values less than 85 ppb. The Roxboro monitor is dropped from the WOE analysis since its 2006 design value is significantly below the current eight-hour ozone standard (78 ppb vs. 85 ppb standard). For the remaining seven sites a number of analyses are undertaken to determine if there is a reasonable chance these sites would meet the ozone standard by the June 2010 attainment date. These include a recent ozone trends analysis, alternative methods for developing baseline concentrations and RRFs, an analysis of regional transport and finally an assessment of the air-quality models response to emission changes.

Nearly all of the design values at the seven monitors declined over the last several years. Only one, Rider College, had a slight increase. Table 7-10 shows the last several years of design values at these seven monitors. It is expected that additional emission reductions due to the NO_x SIP Call, mobile source reductions from fleet turnover as well as additional measures will continue to lower monitor design values. If this trend continues, it is possible that most of these monitors will attain the standard in the next three to five years.

Table 7-10. Recent Design Value (ppb) Trends

Site	2003	2004	2005	2006
Camden	101	93	85	84
Ancora State Hospital	101	95	91	89
Clarksboro	98	94	88	86
Rider	99	91	86	87
Colliers Mills	106	99	94	93
Bristol	100	93	86	86
NE Airport	97	95	90	90

Note: Design values are in ppb.

Table 7-11 summarizes the results for the US EPA method as well as some alternative methods including alternative background concentrations calculations and alternative RRF calculations as well as the results from employing both methods simultaneously. Descriptions of these alternative methods and the reasons for employing them can be found in sections 7.8.2.3. Results from the alternative methods analysis indicate nearly all seven of the monitors will be near the standard by the projected attainment date.

Table 7-11. Alternative Methods WOE

Site	Modeled 2009			
	EPA Method	**Alt Baseline DV**	**Alt RRF**	**Both**
Camden	88	83	87	83
Ancora State Hospital	87	85	87	85
Clarksboro	88	85	86	85
Rider	86	84	86	84
Colliers Mills	91	91	91	91
Bristol	88	85	88	85
NE Airport	87	84	84	84

Note: Design values are in ppb.

Regional transport is a significant contributor to the non-attainment problem in the PA-NJ-DE-MD region. An analysis of modeled ozone concentrations at the Methodist Hill site in south-central Pennsylvania, a high elevation site, determined how well the

OTC air-quality model simulated the regional transport component. The modeled 2009 concentration at Methodist Hill is approximately 6 ppb higher than the monitor's current design value. This suggests the model is under predicting the benefits of the NO_x SIP Call in upwind regions. To counter this underestimation, a uniform reduction of 6 ppb could be taken off the modeled 2009 concentrations at the seven monitors included in the WOE. This brings all values below the current eight-hour ozone standard (Colliers Mills adjusted to 85 ppb). The adjusted concentrations at the seven monitors are summarized in Table 7-12.

Table 7-12. Adjustments in DVF Due To Model Under-prediction of NOx SIP Call Benefits

Site	2009 DVF w/Alt. baseline DV & RRF Adjustment	2009 DVF w/Adjustment for NOx SIP Call Benefits
Camden	83	76
Ancora State Hospital	85	78
Clarksboro	85	78
Rider	84	79
Colliers Mills	91	85
Bristol	85	79
NE Airport	84	78

Note: Design values are in ppb.

Now we take into consideration CMAQ's underprediction of benefits from the Blackout Study and the affect of uncertainties as discussed previously. For the former, the modeled benefits are adjusted with a multiplication factor of 1.5 and the latter by bounding the adjusted concentration with a 3.1 ppb. The effect of changes on future design values is listed in Table 7-13.

Table 7-13. Adjustments in DVF Due To Model Underprediction of Benefits

Site	Baseline DV	Modeled 2009 O3	Modeled Benefit	1.5 x Modeled Benefit	Adjusted 2009 DV	Adjusted 2009 DV, Lower Bound	Adjusted 2009 DV, Upper Bound
Camden	98	88	10	15	83	79.9	86.1
Ancora State Hospital	100	87	13	19.5	80	76.9	83.1
Clarksboro	98	88	10	15	83	79.9	86.1
Rider	97	87	10	15	82	78.9	85.1
Colliers	105	91	14	21	84	80.9	87.1

Site	Baseline DV	Modeled 2009 O3	Modeled Benefit	1.5 x Modeled Benefit	Adjusted 2009 DV	Adjusted 2009 DV, Lower Bound	Adjusted 2009 DV, Upper Bound
Mills							
Bristol	99	88	11	16.5	82	78.9	85.1
NE Airport	97	87	10	15	82	78.9	85.1

Note: Design values are in ppb.

7.8.2.8 Delaware-specific Additional Control Measures

Delaware is implementing several measures that are not modeled as part of the SIP attainment demonstration, and these measures yield significant VOC and NOx reductions. Two of these measures are anti-idling prohibitions (Delaware Regulation No. 1145) and ozone action days (voluntary program), and the potential reductions from these measures are summarized in Table 7-14. These two measures will help attain the standard in 2009.

Table 7-14. Potential Emission Reductions (tons/day) from Delaware-specific Measures Not Modeled

Control Measures	NOx	VOC
Anti-idling	4.0	0.10
Ozone action days	1.0 – 2.0	0.5 – 1.0

In addition, mandatory episodic controls that were not modeled, such as Delaware's prohibition of lightering on ozone action days (Reg. 1124, Section 36), and reduction of emissions from high electric demand day electric generation (Reg. 1146 and Reg. 1148) will also gain very significant VOC and NOX reductions, and will help reduce future exceedances of the ozone NAAQS.

7.8.2.9 Reserved.

7.8.2.10 Statistical Rollback to Estimate RRFs

Environmental data commonly exhibits as lognormal rather than a normal distribution. The effect of control measures on the monitored is generally studied by combining the lognormal distribution with statistical theory of rollback. Georgopoulos and Seinfeld described the NO2 concentrations with a 2-parameter log-normal distribution and determined the post-control concentrations by this approach (Reference 7-11). The source control theory is applicable to any distribution (Reference 7-12). Delaware extends this approach to demonstrate that a range of RRFs can be derived from the CMAQ modeled results.

Figure 7-7 shows the density plot of log CMAQ concentrations for 2002 base case that exceed 70 ppb at the monitor; this also includes concentrations within the 3x3 cells of the monitor. The figure also shows the plot for the corresponding 2009 CMAQ concentrations. Cumulative frequencies are derived and plotted for both cases (Figure 7-8). The effectiveness of controls on the base case can be read for any probability and then determine the corresponding RRF. For example, for a cumulative probability of 1, modeled concentrations of the base case (red) and the future case (blue) can be read, and the ratio of the two determines the RRF. It can also be seen that the control measures are more effective at lower ozone levels than at upper extremes. The RRFs determined this way differ for every probability yielding a range of RRF numbers, upper bound of which is more protective of NAAQS. The upper bound of the RRF derived by this method (~0.7), yields the future design value at Colliers Mills to be 74 ppb.

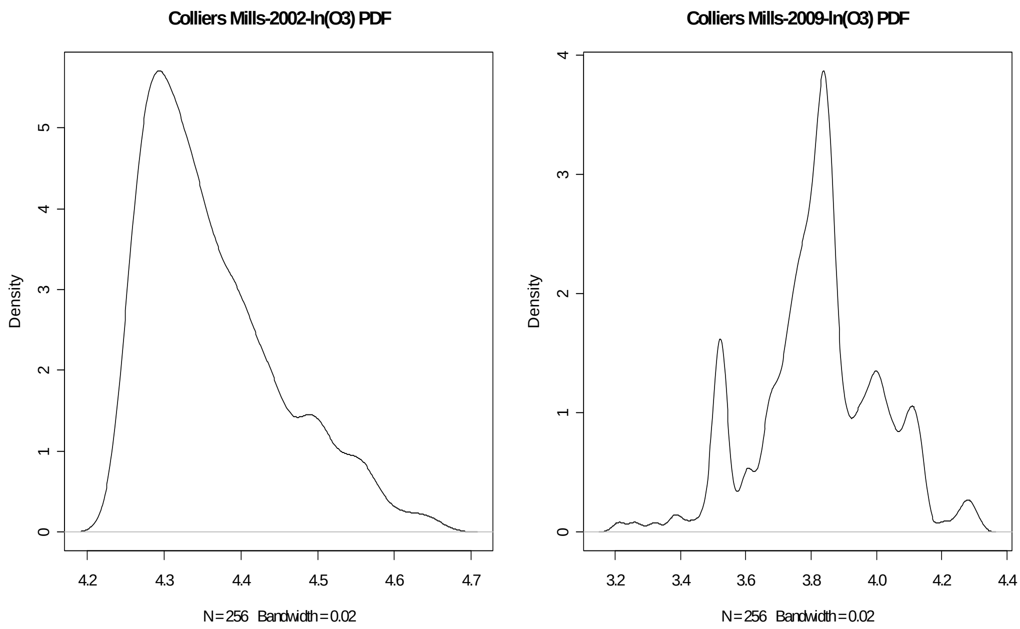

Figure 7-7. Density Plots of Log CMAQ Concentrations for 2002 Base and 2009 Cases

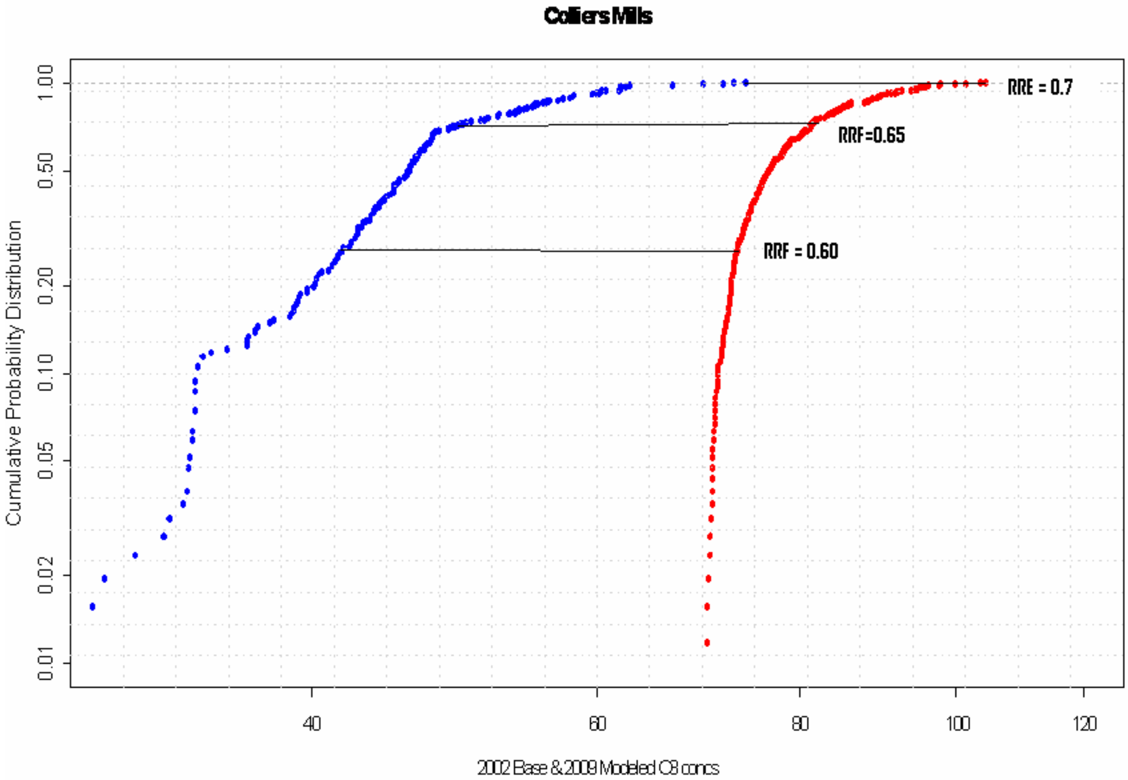

Figure 7-8. Frequency Distributions of 2002 Base and 2009 CMAQ Ozone Concentrations (log-log Plot)

7.9 Conclusions

The CMAQ modeling results presented above show that of the 22 monitors in the PA-NJ-DE-MD non-attainment area only 8 monitors have predicted 2009 modeled concentrations above 82 ppb. This represents in a significant improvement in air quality.

The WOE analyses presented above include a recent ozone trends analysis, alternative methods for developing baseline concentrations and RRFs, an analysis of regional transport, an assessment of the air-quality models response to emission changes, the identification of several Delaware-specific control measures that were not included in the modeling, and a statistical rollback approach analysis.

Of the WOE analyses presented above, the alternative methods of developing baseline design values and RRFs indicate that 2009 projected design values will likely be below 85 ppb for all monitors except for Colliers Mills, which is projected at 91 ppb. Monitoring results at Method Hill monitor proved that the model is likely over predicting the concentrations by at least 6 ppb. Applying this correction to the 2009 design values indicates that all the monitors, including Colliers Mills will likely be below 85 ppb in 2009. Furthermore, the correction for CMAQ's underprediction of benefits and uncertainties in outputs due to meteorology and emissions bounds the Colliers Mills design values in the range of [80.9, 87.1] ppb. In addition, the statistical rollback approach provided an indication that a range of RRFs is likely and that an upper bound at the Colliers Mills monitors would be at approximately 74 ppb, thus providing an indication that all monitors in the non-attainment area are likely to attain the NAAQS.

The 2006 monitored design values are already at 2009 model predicted design values, with the trends analyses of the monitored values giving a strong indication that all the monitors in the non-attainment area will attain the NAAQS in 2009. Additional Delaware-specific control measures, which are not part of the 2009 OTB/OTW measures, will prove beneficial in reducing the ozone concentrations below the standard. It is also expected that additional emission reductions due to CAIR, mobile source reductions from fleet turnover as well as other additional measures, will continue to lower monitor design values beyond 2009.

The photochemical grid modeling presented above indicates that the control measures will reduce the 8-hour ozone levels to below 85 ppb at most of the monitors in the non-attainment area, whereas the unmonitored area analysis provides evidence that all unmonitored areas in the non-attainment area will attain the 8-hour ozone levels in 2009.

Together, all of the WOE analyses discussed above provides a strong indication that downward trend of ozone levels will continue and all monitors will be below the 85 ppb 8-hour ozone standard in 2009.

References

7-1. *Technical Supporting Document*, *Final Report*, Ozone Transport Assessment Group (OTAG), Office of Air Quality Planning & Standards, U.S. Environmental Protection Agency, Technology Transfer Network, 1997.

7-2. *NOx Budget Trading Program Report: 2005 Program Compliance and Environmental Results*, U.S. Environmental Protection Agency, September 2006.

7-3. *Evaluating Ozone Control Programs in the Eastern United States: Focus on the NOx Budget Trading Program, Air Trends Report*, U.S. Environmental Protection Agency, 2004, http://www.epa.gov/airtrends/2005/ozonenbp/.

7-4. *Guidance on the Use of Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS (Final version)*, U.S. Environmental Protection Agency, 2005.

7-5. *Delaware protocol for the modeled attainment demonstration of the 8-hour ozone NAAQS*, Air Quality Management Section, Department of Natural Resources and Environmental Control, Dover, Delaware, June 2006.

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7-12. Wayne R Ott, 1995: *Environmental Statistics and Data Analysis*, CRC Press, Inc.

8. Reasonably Available Control Measure (RACM) Analysis

8.1 RACM Analysis Requirements

The CAAA and 40 CFR 51.912(d) impose a Reasonably Available Control Measures (RACM) requirement for areas designated non-attainment for the 8-hour NAAQS. According to this requirement, Delaware must demonstrate that it has adopted all RACM controls necessary to move toward attainment as expeditiously as practicable and to meet all RFP requirements.

8.2 RACM Determination

Sections 5, 6 and 7 of this document demonstrate that the RFP requirements for Delaware have been met, and that attainment will be reached in 2009. The RFP and attainment demonstration are based on the control measures identified in Sections 6 and 7 of this document. Additional RACM measures must be implemented if such measures will advance the attainment date to 2008.

Control measures under the Reasonably Available Control Technology (RACT) constitute a major group of RACM control measures for stationary sources. To meet the CAA's RACT requirements under the 8-hour ozone standard, Delaware has submitted to EPA a RACT SIP revision, which certifies in detail that all relevant RACT controls, except one control, have been implemented in Delaware for attaining the 8-hour ozone standard (Reference 8-1). The one exception, the VOC control for crude oil lightering operations, has been completed since the RACT SIP revision was submitted to the EPA, and become effective in May 2007. A list of all these adopted RACT measures is extensive, and is detailed in the RACT SIP revision (Reference 8-1).

In addition to the RACT control measures discussed above, Delaware has adopted a number of other VOC and NOx RACM measures. These measures include the tightening of Delaware's Open Burning Regulation (Delaware Air Pollution Control Regulation No. 1113), Control of Stationary Generator Emissions (Delaware Air Pollution Control Regulation No. 1144), restrictions on Excessive Idling of Heavy Duty Vehicles (Delaware Air Pollution Control Regulation No. 1145), Control of Stationary Combustion Turbine Emissions (proposed Regulation No. 1148), and measures such as the Brandywine School Districts Clean School Bus USA grant, and voluntary and mandatory Ozone Action Day initiatives.

Delaware believes that it has met the RACM requirements of the CAA. To demonstrate that there are no additional RACM measures, or group of RACM measures that DE could adopt to advance the attainment date from 2009 to 2008, Delaware analyzed zero out modeling using CALGRID (see Appendix 8-1). This modeling indicates that Delaware's total maximum contribution to the worst case monitor in the Philadelphia Nonattainment area (i.e., the Collars Mills monitor in Ocean County, NJ) is about 7 ppb (Figure 8-1).

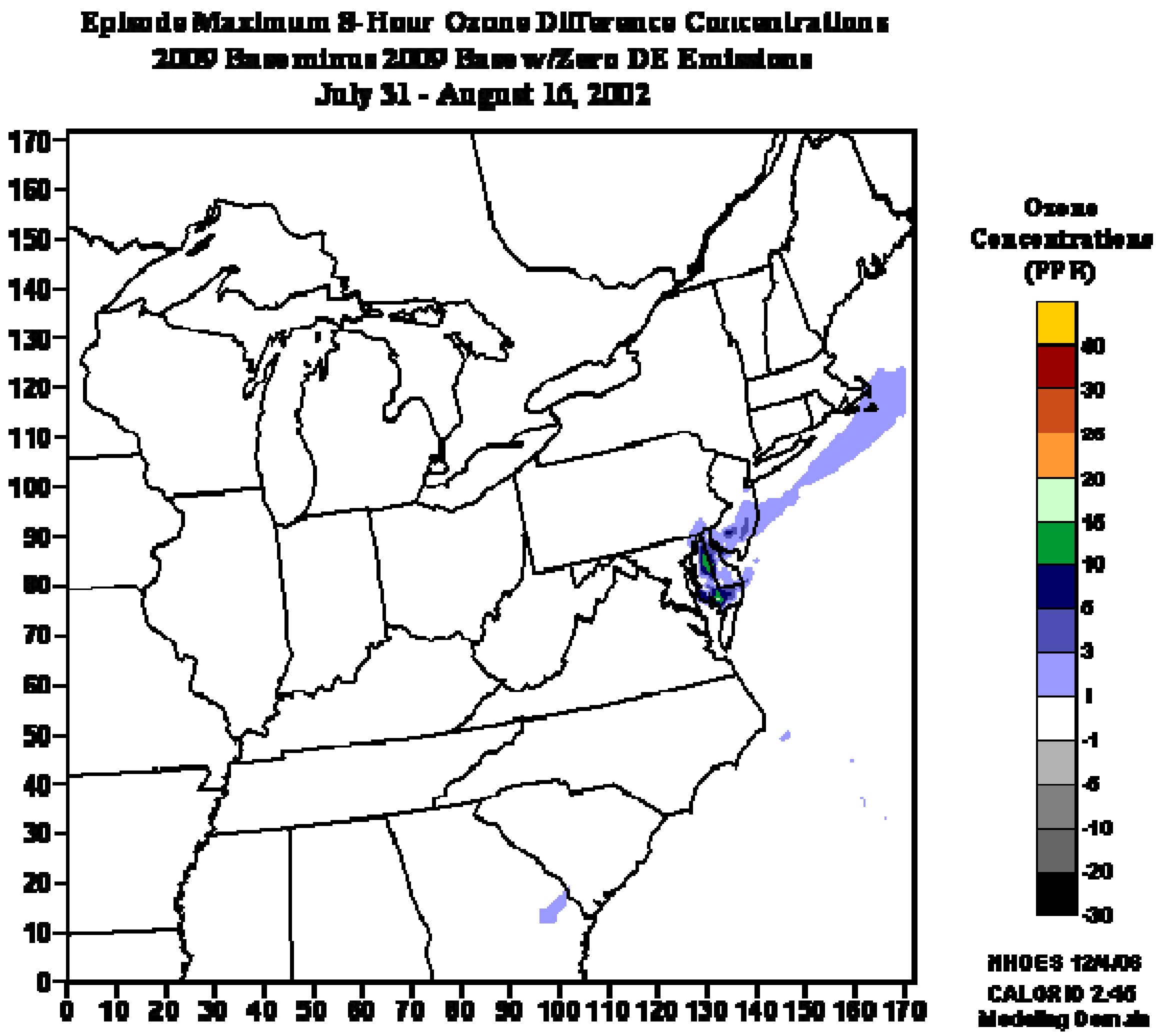

Figure 8-1. Delaware Zero-Out Modeling Results For Estimating Contribution to Ozone Concentration

In its zero-out modeling for CAIR (using CAMx), EPA assessed the impact of each upwind state on a number of downwind counties, including Ocean County, NJ (Appendix G, Technical Supporting Document of Reference 8-2). The individual maximum 8-hour ozone contributions from each upwind state PA, MD, VA, NC, DE, OH, WV, and MI are 31.6, 1.24, 11.6, 7.1, 6.5, 4.0, 3.6, and 3.5 ppb, respectively. It should be noted that (1) not all the impacting states are listed here, and (2) the total out-of-state contribution to ozone concentrations in Ocean County, NJ is predicted by CAIR modeling to be 86% of 95 ppb = 85 ppb (see below)). The CAMx zero-out contribution of 6.5 ppb from Delaware is consistent with Delaware's 7 ppb estimate from CALGRID zero-out modeling.

Table VIII-11 of EPA's Interstate Air Quality Rule technical supporting document (Reference 8-2) also lists the projected 8-hour ozone design values and the percent total average contribution resulting from emissions in upwind states. For example, the projected 2010 design value for Ocean County, NJ is 99 ppb of which 86% (i.e., 85 ppbs) of ozone is due to out-of-state transport. Of these 85 ppbs, the maximum Delaware contribution is only 6.5 ppb or 4.2%.

From Section 7 of this document, all local and regional emission reductions planned to occur by 2009 project the entire Philadelphia non-attainment area to attain by 2009, and project a reduction in Ocean County NJ (i.e., the location of the worst case monitor in the non-attainment area) ozone concentrations from 106 ppb to about 85 ppb (i.e., about 21 ppb reduction). Significant emission reductions occur between 2008 and 2009 due to Federal programs like CAIR, and mobile reductions from the penetration of federal rules due to fleet turnover. Therefore, even if Delaware were able to zero out its 7 ppb contribution, Ocean County will remain non-attainment unless a majority of these other measures were also advanced to 2008. Since a large portion of these significant reductions cannot be advanced, as the CAIR and Federal mobile reduction compliance dates are set, and since Delaware's overall impact is relatively small compared to the benefit obtained from these measures which cannot be advanced from 2009 to 2008, there are no additional RACM measures DE can take to advance the attainment date to 2008.

References

8-1. *Delaware Reasonably Available Control Technology (RACT) State Implementation Plan under the 8-Hour Ozone National Ambient Air Quality Standard*, Delaware Department of Natural Resources and Environmental Control, Air Quality Management Section, Dover, Delaware, submitted to EPA in September 2006.

8-2. *Technical Support Document for the Interstate Air Quality Rule: Air Quality Modeling Analyses*, US EPA, January 2004.

9. Mobile Budgets for Transportation Conformity

9.1 Introduction to Transportation Conformity

Section 176 of the Clean Air Act requires that highway transportation activities in ozone non-attainment areas must not impair progress in air quality improvements. In general, this requirement specifies that (1) states establish, in their state implementation plans (SIP), mobile source VOC and NOx emission budgets for each of the milestone years up to the attainment year, and submit the mobile budgets to EPA for approval, (2) upon adequacy determination or approval of EPA, states must conduct transportation conformity analysis for their Transportation Improvement Programs (TIPs) and long range transportation plans to ensure that future highway vehicle emissions will not exceed relevant mobile budgets, and (3) failure of demonstrating such transportation conformity in TIPs and long range plans will lead to conformity lapse(s), resulting in freezing of federal highway funds and all federal highway projects in the lapsed area.

According to EPA's Phase 2 Implementation Rule (*70 FR 71612*), Delaware is required to establish mobile budgets for the year 2008 (the 15% RFP emission reduction milestone year) and the year 2009 (the attainment year). To meet this requirement, Delaware has developed a mobile budget SIP revision and submitted to EPA in May 2007 (need to revise to the final submittal date). The final submittal of that SIP revision is presented in Appendix 9-1 of this document.

This section is a summary of Delaware's mobile budget SIP revision.

9.2 Mobile Budgets for 2008 and Attainment Year

The mobile emissions budgets for 2008 RFP milestone and 2009 attainment are based on the projected 2008 and 2009 mobile source emissions, accounting for all relevant mobile source controls including all federal controls and Delaware specific controls as described in Section 6. The 2008 and 2009 mobile emissions are projected using EPA's MOBILE6.2 for obtaining emission factors and the "Peninsula Travel Demand Model" for predicting future vehicle miles traveled (VMT). The MOBILE6.2 runs were conducted by AQM's staff using the most recent available vehicle registration data and speed estimates (2005). Details of how to calculate the 2008 and 2009 mobile emission projections are presented in Appendix 9-1.

9.2.1 Mobile Budgets for 2008 RFP Milestone Year

Table 9-1 is a summary of 2008 mobile source emission projections for each of the three counties in Delaware. Delaware herein establishes county-by-county VOC and NOx emission budgets for each county as specified in Table 9-1 for the milestone year 2008.

Table 9-1. On-Road Mobile Source Emission Projections for 2008

		2008 Emissions	
County	**FIPS**	**VOC**	**NOx**
Kent	10001	4.14	9.68
New Castle	10003	10.61	21.35
Sussex	10005	7.09	12.86

State Total		**21.84**	**43.89**

9.2.2 Mobile Budgets for 2009 Attainment Year

Table 9-2 is a summary of 2009 mobile source emission projections for each of the three counties in Delaware. Delaware herein establishes county-by-county VOC and NOx emission budgets for each county as specified in Table 9-2 for the attainment year 2009.

Table 9-2. On-Road Mobile Source Emission Projections for 2009

		2009 Emissions	
County	**FIPS**	**VOC**	**NOx**
Kent	10001	3.95	9.04
New Castle	10003	9.89	19.23
Sussex	10005	7.05	11.93
State Total		**20.89**	**40.20**

10. Contingency Measures

10.1 Requirements on Contingency Measures

The CAAA requires States with non-attainment areas to implement specific control measures if the area fails to make reasonable further progress, fails to meet any applicable milestone, or fails to attain the national ambient air quality standards by the applicable attainment date. The EPA has interpreted this CAAA provision as a requirement for States with moderate and above ozone non-attainment areas to include sufficient contingency measures in their RFP and attainment demonstration so that, upon implementation of such measures, additional emission reductions of at least 3% of the adjusted 2002 baseline emissions would be achieved (Reference 10-1). Under the same provision of the CAAA, EPA also requires that the contingency measures must be fully-adopted control measures or rules, so that, upon failure to meet milestone requirements or to attain the standards, the contingency measures can be implemented without any further rulemaking activities by the States and/or EPA.

To meet the requirements for contingency emission reductions, EPA allows States to use NOx emission reductions to substitute for VOC emission reductions in their contingency plans. The condition set forth by EPA for NOx substitution is that States must achieve a minimum of 0.3% VOC reductions of the total 3% contingency reduction, and the remaining 2.7% reduction can be achieved through NOx emission controls (Reference 10-2). Delaware is including both VOC and NOx emission controls as contingency measures in this 8-hour ozone RFP and Attainment Demonstration SIP revision.

10.2 Contingency Measures for 2008 Milestone Year

Based on CAAA and EPA requirements on contingency measures, the contingency VOC reduction for Delaware for the 2008 milestone year can be estimated as follows:

The 2002 VOC baseline (state-wide) adjusted to 2008 (See Tables 4-3 and 4-4):	111.36 TPD
Contingency VOC emission reduction in 2008:	111.36 x 3 % = 3.34 TPD

Analysis in Subsection 5.5 indicates that the three counties in Delaware together will have a VOC emission reduction surplus of 1.82 TPD in 2008 [i.e., (33.00 + 61.66) – (32.13 + 60.71) = (94.66 - 92.84) = 1.82]. Therefore, there is a 3.34 – 1.82 = 1.52 TPD contingency VOC reduction shortfall in 2008.

Delaware's 2002 VOC-to-NOx baseline (with respect to 2008) ratio is (38.82+72.54):(55.95+137.34) = 111.36:193.29 = 1:1.74 (See Tables 4-3 and 4-4 in Section 4). Therefore, the above contingency VOC reduction shortfall is equivalent to 1.52 x 1.74 = 2.64 TPD NOx reduction shortfall.

As discussed in Subsections 5.4 and 6.4, Delaware has implemented numerous controls, which will lead to NOx emission reductions in 2008. For example, Subsection 5.4.3 indicates that all three counties in Delaware will achieve significant NOx emission reductions in 2008, which are greater than the identified 2.64 contingency shortfall.

Therefore, there is no need to specify additional contingency measures for the 2008 milestone year.

10.3 Contingency Measures for 2009 Attainment Year

In January 2007, Delaware participated with the OTC in proposing a list of additional controls as model rules to aid the OTR states to attain the 8-hour ozone standard in 2009 (Appendix 10-1). As part of this contingency plan, Delaware commits to adopt the following model rules in May 2008 with a compliance date of May 1, 2009:

(1) Consumer Products.
(2) Portable Fuel Containers.
(3) Adhesives and Sealants Application.

According to OTC's technical supporting document for (1), (2) and (3), adopting these OTC model rules in Delaware will lead to 1.2 TPD VOC reduction in 2009 (Appendix 10-2). The percentage of these 3 controls relative to the 2002 VOC baseline can be estimated as follows:

The 2002 VOC baseline (state-wide)
adjusted to 2009 (See Tables 4-3 and 4-4): 111.28 TPD
VOC Reduction representing % of 2002 Baseline: 1.2/111.28 = 1.1%

As indicated in Subsection 6.5 of this SIP revision, Delaware has 2.70 TPD NOx emission surplus that will be used for contingency purposes. The percentage of the NOx surplus relative to the 2002 VOC baseline can be estimated as follows:

The 2002 NOx baseline (state-wide)
adjusted to 2009 (See Tables 4-3 and 4-4): 192.94 TPD
NOx surplus representing % of 2002 Baseline: 2.70/192.94 = 1.4%

As discussed in Subsection 7.8.2.8 of this document, Delaware has implemented "ozone action days" (also known as "air quality alert days") as voluntary control during the ozone season. The program provides an estimated 0.5-1.0 TPD VOC reduction and 1.0-2.0 TPD NOx reduction. Using the lower ends of the reduction ranges for conservative estimates, the percentages are:

For VOC: 0.5/111.28 = 0.4%
For NOx: 1.0/192.94 = 0.5%

The total achievable contingency % relative to the 2002 baseline is: VOC% + NOx% = (1.1% + 0.4%) + (1.4% + 0.5%) = 3.4%, and therefore meets the CAAA and EPA emission reduction requirements for contingency in the 2009 attainment year.

References

10-1. *Guidance for Growth Factors, Projections, and Control Strategies for the 15 Percent Rate-of-Progress Plans,* EPA-452/R-93-002, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research

Triangle Park, North Carolina, March 1993.

10-2. *Guidance on the Post-1996 Rate-of-Progress Plan and the Attainment Demonstration*, Ozone/Carbon Monoxide Programs Branch, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711, February 18, 1994.

11. Appendices

A collection of the listed appendixes, stored on CD, will be available upon written request to AQM-DAWM-DNREC, 156 South State Street, Dover, DE 19901.

Appendix 4-1

Part 1: MOBILE6.2 Input and Output Files for Delaware 2002, 2008 and 2009 Mobile Source Emission Adjustments.

Part 2: Calculations of the Adjusted 2002, 2008 and 2009 On-Road Mobile Source Emission Projections.

Appendix 6-1

Development of Emission Projections for 2009, 2012, and 2018 for Non-EGU Point, Area, and Non-road Sources in the MANE-VU Region, Draft Final Technical Support Document, Prepared for Mid-Atlantic Regional Air Management Association (MARAMA) by MACTEC Federal Programs, Inc., December 7, 2006.

Appendix 6-2

The 2009 Emission Projections of Delaware Non-EGU, Non-Point and Non-Road Mobile Sources.

Appendix 6-3

Part 1: MOBILE6.2 Input and Output Files for Delaware 2008 and 2009 Mobile Source Emission Projections.

Part 2: Calculations of 2008 and 2009 On-Road Mobile Source Emission Projections

Appendix 7-1

A Modeling Protocol for the OTC SIP Quality Modeling System for Assessment of the Ozone National Ambient Air Quality Standard in the Ozone Transport Region, The Modeling Committee of the Ozone Transport Commission (OTC), OTC, 2000.

Appendix 7-2

Technical Supporting Document 1d: The 8-hour Ozone Modeling Using the SMOKE/CMAQ System, Bureau of Air Quality Analysis and Research, Division of Air Resources, New York State Department of Environmental Conservation, Albany, NY, February 2006.

Appendix 7-3

Determination of Representativeness of 2002 Ozone Season for Ozone Transport Region SIP Modeling, Prepared for OTC, Prepared by Environ, June 2005.

Appendix 7-4

Qualitative Episode Analysis of the 2002 Ozone Season, William F. Ryan, Department of Meteorology, Pennsylvania State University, and Charles Piety, Department of Atmospheric and Oceanic Science, University of Maryland, 2002.

Appendix 7-5

Technical Supporting Document 1a: Meteorological Modeling using Penn State/NCAR 5th Generation Mesoscale Model (MMV), Bureau of Air Quality Analysis and Research Division of Air Resources, New York State Department of Environmental Conservation Albany, NY, February 2006.

Appendix 7-6

Technical Supporting Document 1e: CMAQ Model Performance and Assessment- 8-Hour Ozone Modeling, Bureau of Air Quality Analysis and Research, Division of Air Resources, New York State Department of Environment, Albany, NY, February 2006.

Appendix 7-7

Technical Supporting Document 1b: Processing of Biogenic Emissions for OTC/MANE_VU Modeling, Bureau of Air Quality Analysis and Research, Division of

Air Resources, New York State Department of Environment, Albany, NY, September 2006.

Appendix 7-8

Technical Supporting Document 1c: Emission Processing for the Revised 2002 OTC Regional and Urban 12 km Base Case Simulations, Bureau of Air Quality Analysis and Research, Division of Air Resources, New York State Department of Environment, Albany, NY, September 2006.

Appendix 7-9

Technical Supporting Document 1f: Future Year Emissions Inventory for 8-Hr OTC Ozone Modeling, Bureau of Air Quality Analysis and Research, Division of Air Resources, New York State Department of Environment, Albany, NY, February 2007.

Appendix 7-10

The Nature of the Ozone Air Quality Problem in the Ozone Transport Region: A Conceptual Description, NESCAUM, October 2006.

Appendix 7-11

A Conceptual Model for Ozone Transport, Prepared by Dr. Robert Hudson, Department of Atmospheric & Science, University of Maryland, January 2006.

Appendix 7-12

A Guide to Mid-Atlantic Regional Air Quality, Mid-Atlantic Regional Air Management Association (MARAMA), October 2005.

Appendix 7-13

Technical Supporting Document aa: Trends in Measured 1-hour Ozone Concentrations over the OTR modeling domain, Bureau of Air Quality Analysis and Research, Division of Air Resources, New York State Department of Environment, Albany, NY, September 2006.

Appendix 8-1

CALGRID Zero Out Modeling Analysis, Mohammed A. Majeed, Ph.D. and P.E., Air Quality Management Section, Delaware Department of natural Resources and Environmental Control, Dover, DE, May 2007

Appendix 9-1

Delaware State Implementation Plan for Attainment of the 8-Hour Ozone National Ambient Air Quality Standard, Revision for Establishment of 2008 and 2009 Mobile Source Emission Budgets, Delaware Department of Natural Resources and Environmental Control, Air Quality Management Section, Dover, Delaware, May 2007.

Appendix 10-1

Identification and Evaluation of Candidate Control Measures, Draft Final Technical Support Document, Prepared for Ozone Transport Commission (OTC), Prepared by MACTEC Federal Programs, Inc., Herndon, Virginia, February, 2007